PB90-138397

Superfund Record of Decision (EPA Region 1): Wells G and H Woburn, Massachusetts (First Remedial Action), September 1989

(U.S.) Environmental Protection Agency, Washington, DC

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The Wells G&H site encompasses 330 acres within the zone of contribution of two municipal drinking water wells known as Well G and Well H, commonly referred to as Wells G&H, in Woburn, Massachusetts. The area near the wells consists of industrial, commercial, residential, and recreational development. The Aberjona River flows through the site, and a substantial onsite wetlands area is associated with the river's floodplain. Wells G&H were developed in the 1960s and provided over one quarter of the Woburn community water supply. In 1979 the State closed the wells and provided the community with an alternate water supply after detecting several chlorinated volatile organic compounds (VOCs) in the wells. EPA investigations beginning in 1981 resulted in the site being divided into three discrete operable units: first, five properties inside the perimeter of the site boundary which were identified as source areas of contamination; second, a central area immediately surrounding Wells G&H with extensive ground water contamination; and third, a segment of the Aberjona River and associated wetlands containing contaminated sediment. Between 1983 and 1989 EPA issued several Administrative Orders to site property owners requiring cleanup activities including limiting site access and removing drums and debris. This Record of Decision (ROD) addresses remediating contaminated soil and ground water found at the first operable unit, the five properties identified as principal sources of (See Attached Sheet)

cont to pg ii

17. Document Analysis a. Descriptors

Record of Decision - Wells G&H, MA
First Remedial Action
Contaminated Media: soil, sludge, debris, gw
Key Contaminants: VOCs (PCE, TCE), other organics (PAHs, PCBs, pesticides), metals (lead)

b. Identifiers/Open-Ended Terms

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Wells G&H, MA
First Remedial Action

16. Abstract (continued)

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contamination, and further evaluating the remaining operable units. A subsequent ROD will address the second and third operable units which include the central area of the site and the river sediment. The primary contaminants of concern affecting the soil, sludge, debris, and ground water are VOCs including PCE and TCE; other organics including carcinogenic PAHs (cPAHs), PCBs, and pesticides; and metals including lead.

The selected remedial action for this site are includes in situ volatilization, using carbon adsorption for treatment of the extracted vapor, of the 7,400 cubic yards of soil contaminated with VOCs only; excavation and onsite incineration of 3,100 cubic yards of the remaining contaminated soil and backfilling of the excavated areas; pumping and treatment of ground water from the five source areas only, using pretreatment for metals followed by air stripping and vapor phase carbon filtering with either discharge onsite to the Aberjona River or reinjection into the aquifer or both; removing and disposing of 410 cubic yards of sludge and debris; and ground water monitoring. The estimated present worth cost for this remedial action is $68,400,000.

PB90-138397

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R01-89/036
September 1989

EPA

Superfund Record of Decision:

Wells G&H, MA

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Declaration of the Record of Decision

Site Name and Location

Wells G & H
Woburn, Massachusetts

Statement of Purpose

This decision document presents the selected remedial action for the Wells G & H site in Woburn, Massachusetts, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP); 40 CFR Part 300 et seq., 47 Federal Register 31180 (July 16, 1982), as amended.

The Commonwealth of Massachusetts has concurred with the selected remedy.

Statement of Basis

This decision is based on the administrative record which was developed in accordance with Section 113(k) of CERCLA and which is available for public review at the information repositories located at the Woburn Public Library, Woburn, Massachusetts, and at 90 Canal Street, Boston, Massachusetts. The attached index identifies the items which comprise the administrative record upon which the selection of a remedial action is based.

Description of the Selected Remedy

The selected remedial action for the Wells G & H site will be conducted as the first operable unit and consists of a source control and management of migration component for the five properties identified as sources of contamination. This approach is appropriate as the source areas of contamination contain the majority of the mass of contaminants at the site, and pose the principal threat at the site.

The Aberjona River and the central area of the site surrounding Wells G & H will be addressed as a separate operable unit.

The source control remedial measures include:

- Excavation and on-site incineration of approximately 2100 cubic yards of contaminated soil. Excavated areas will be backfilled.
- In situ volatilization of approximately 7400 cubic yards of contaminated soil, part of which is located in a wetlands area. In situ treatment will use carbon adsorption for vapor treatment.

The management of migration remedial measures include:

- Pumping contaminated groundwater from the overburden and/or bedrock aquifers, pretreatment to remove suspended solids and metals, and treatment by air stripping to remove contaminants. Carbon adsorption will be used to treat emissions from the air stripper.
- Groundwater will be treated at separate source area treatment plants.
- Groundwater will be pumped with the objective of achieving Safe Drinking Water Act Maximum Contaminant Levels in the aquifer.

Additional measures include:

- The removal and disposal of approximately 410 cubic yards of sludge and debris.

Declaration

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action, and is cost effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy is being conducted as the first operable unit at the site, it will result in hazardous substances remaining on-site above health based levels. A review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Sept 14, 1989
Date

Paul G. Keough
Paul G. Keough
Acting Regional Administrator, EPA Region I

WELLS G & H

RECORD OF DECISION

WELLS G & H

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ROD DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

SITE NAME: Wells G & H

SITE LOCATION: Woburn, Massachusetts

SITE DESCRIPTION:

The Wells G & H Site (Site) located in east Woburn, Massachusetts includes the aquifer and land mass area located within the zone of contribution of the two municipal drinking water wells known as Wells G and H. The Site is bounded by Route 128 to the north, Route 93 to the east, the Boston and Maine railroad to the west, and Salem Street to the south. It is approximately 330 acres (see Figure 1).

Wells G & H are located in the sand and gravel aquifer of the Aberjona River basin within the Mystic River watershed. The area surrounding the wells within the Site boundary is a mixed use area consisting of light industry, commercial businesses, industrial parks, residences, and recreational property. The area surrounding the Site is dominated by industrial and commercial property to the North, and residential property to the South.

The Aberjona River, which begins in Reading, Massachusetts, flows through the Site and eventually reaches the Mystic Lakes in Winchester. A substantial wetland area associated with the Aberjona River flood plain is located on either side of the River within the Site boundary. An additional description of the Site can be found in the Supplemental Remedial Investigation Report at page 1.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Site Use History

Wells G & H were developed by the City of Woburn in 1964 and 1967, respectively. The wells, screened in the Aberjona River aquifer and capable of supplying two million gallons of water per day, were initially intended to supplement previously existing supplies. Local officials estimate that 27-28% of the community's water supply was provided by Wells G & H. The remainder of the water supply was provided by seven wells located near Horn Pond south of Salem Street. These wells are located in a different aquifer from Wells G & H and are not affected by contamination present in the study area. Woburn currently uses the Horn Pond water as its major water supply.

In 1979, the Massachusetts Department of Environmental Protection (DEP), formerly the Massachusetts Department of Environmental Quality Engineering, prompted by a local disposal problem, tested the water supply from Wells G & H. Several chlorinated volatile organic compounds, including 1,1,1-trichloroethane (1,1,1-TCA), trans-1,2-Dichloroethene, tetrachloroethene (PCE), and trichloroethene (TCE), were detected at concentrations ranging from 1 to 400 parts per billion (ppb). As a result of this sampling the wells were immediately shut down. Woburn then revived an existing agreement with the Metropolitan District Commission (now the Massachusetts Water Resources Authority or MWRA) to compensate for the lost water supply. The MWRA continues to supplement Woburn's water supply.

As a result of the contamination at Wells G & H, and disposal problems discovered at the Industriplex Superfund Site just north of Wells G & H, the United States Environmental Protection Agency (EPA, or the Agency) conducted a hydrogeologic investigation and groundwater quality evaluation of a ten square mile portion of East and North Woburn. This investigation was conducted in 1981. The purpose of the investigation was to determine the extent and degree of contamination in the aquifer, and to identify the sources of contamination. Based on the direction of groundwater flow, the areal extent of groundwater contamination, and property inspections, EPA identified the source areas for contamination at Wells G & H to be within a one square mile area surrounding the wells on either side of the River within the Site boundary.

The following five facilities have been identified as sources of contamination - W. R. Grace & Company, Unifirst Corporation, New England Plastics, Wildwood Conservation Corporation (also referred to as the Beatrice property), and Olympia Nominee Trust (see Figure 2). Wells G & H, located in the center of these properties, were listed as a Superfund Site on the National Priorities List (NPL) on December 21, 1982.

B. Response History

EPA and various property owners have conducted numerous studies to determine the nature and extent of contamination at the Site. The following is a brief chronological description and summary of those studies. Further explanation can be found in the reports that are summarized below.

1983

EPA completed a report entitled Remedial Action Master Plan for East Woburn. Its purpose was to identify the scope of the sequence of activities necessary to identify and implement remedial action at the Site.

EPA issued three Administrative Orders pursuant to Section 3013 of the Resource Conservation and Recovery Act (RCRA). These Orders required W. R. Grace & Company, Beatrice Foods Inc., and the Unifirst Corporation to investigate the nature and extent of contamination on their properties. These investigations have all been completed and the results have been forwarded to EPA.[1]

1985

The United States Geological Survey (USGS), under an agreement with the EPA, conducted a 30-day aquifer test to determine the zone of contribution of Wells G & H . The description of the study and the results can be found in the report entitled: Area of Influence and Zone of Contribution to Superfund Site Wells G & H, Woburn, Massachusetts, 1987.

EPA issued an Order to the Wildwood Conservation Corporation (Beatrice property) pursuant to Section 106 of CERCLA. This Order required the construction of a fence at the property boundaries to limit contact with soil contamination discovered during previous investigations. In addition, the Order required the presence of a security guard at the Site. Soil data results used to support this action can be found in the Order itself.

An evaluation of the wetlands area within the Site boundary was conducted by EPA to determine the extent and type of wetlands that exist at the Site. The study also evaluated whether there were any adverse impacts to the wetlands as a result of contamination at the Site. Further detail of the study can be found in the report entitled: Wells G & H Wetlands Assessment, Final Report, March 25, 1986, prepared by Alliance Technologies Corp.

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[1] GeoEnvironmental Consultants, Inc., W.R. Grace & Co., Cryovac Division Woburn Plant, Field Investigations and Remedial Measures, Phases I-III, 1983; and W.R. Grace & Co., Cryovac Division, Woburn Plant Field Investigations and Remedial Measures, Phase VI-Field Descriptions, 1985; Woodward-Clyde Consultants, Geohydrology and Groundwater Contamination, J.J. Riley Site, Woburn, Massachusetts, 1984; and Phase II Groundwater Investigation, J.J. Riley Site, Woburn, Massachusetts, 1984; Environmental Research & Technology, Inc., Assessment of Ground Water Contamination Potential at Interstate Uniform Services Corp., Woburn. MA, 1983; Summary of Monitoring Program, Unifirst Corporation, Woburn, MA, 1984; and Evaluation and Recommendations For Alternatives Concerning Additional Investigation of Groundwater Contamination, 1984.

1986

EPA completed a Remedial Investigation which included the installation of groundwater monitoring wells, the collection of samples from the groundwater and surface waters of the Aberjona River, and oversight of work done under the above orders at the Site. The report is entitled: Wells G & H Site, Remedial Investigation Report, Part I, Woburn, Massachusetts, Vol. I-IV, October 17, 1986, prepared by NUS Corporation.

EPA completed a report as an addendum to the RI Part I that focused on the nature and extent of soil contamination at the Site through a review and validation of data previously collected. The report is entitled: Wells G & H Remedial Investigation, Part II, November 1986, prepared by Alliance Corp.

1987

EPA issued an Administrative Order to Unifirst Corporation, pursuant to Section 106 of CERCLA. This Order required Unifirst to install monitoring wells on its property to evaluate the extent of, and to remove, all pure tetrachloroethene contamination found under its property. The results of this investigation can be found in the report entitled: Summary of Investigation, Unifirst Site, Woburn, Massachusetts, February 1988, prepared by ERT. Following this study, Unifirst installed several multi-port bedrock wells downgradient of their property in order to collect groundwater samples. The results of this sampling effort are incorporated in the report entitled: Final Supplemental Remedial Investigation for Feasibility Study, Wells G & H Site, December 1988, prepared by Ebasco Services, Inc.

Under two separate Orders issued by EPA in 1986 and 1987 pursuant to Section 106 of CERCLA, Olympia Nominee Trust removed drums and debris from the western half of its property. The types and levels of contamination are summarized in the individual orders.

1988

EPA completed an Endangerment Assessment which examined the current and future potential risks from exposure to contamination at the Site if no remedial action were to occur. Further details of this study can be found in a report entitled: Endangerment Assessment for the Wells G & H Site, Woburn, Massachusetts, December 1988, prepared by Clement Associates, Inc.

EPA completed a supplemental Remedial Investigation which involved gathering additional soil information at several source areas, installing additional monitoring wells and collecting samples, updating groundwater information from existing wells, and collecting sediment and surface water samples from the Aberjona River. The results of the study can be found in the report entitled: Final Supplemental Remedial Investigation for Feasibility Study, Wells G & H Site, Woburn, Massachusetts, December 1988, prepared by Ebasco Services Inc.

1989

EPA conducted soil sampling at the W. R. Grace and Olympia Nominee Trust properties in July and August, 1989. Soil borings originally sampled and reported in the Final Supplemental Remedial Investigation for Feasibility Study, December 1988, were repeated in order to confirm earlier results. This sampling was initiated in response to concerns regarding the laboratory that analyzed the original samples. The results of the soil sampling conducted in July and August confirm the earlier results. Further details can be found in the report entitled: Soil Sampling at the Wells G & H Superfund Site (W.R. Grace and Olympia Nominee Trust), July/August 1989, EPA.

In addition to the above studies done by or for EPA, the DEP has been involved in investigating activities at properties that border the Site. Property owned by the Whitney Barrel Company, Olympia Nominee Trust, and Weyerhauser are currently under investigation by DEP due to groundwater contamination found at these sites.

C. Enforcement History

On April 20, 1988, EPA notified eight potentially responsible parties (PRPs) of their potential liability for response actions at the Site. On February 3, 1989, EPA notified an additional 14 parties. In addition, PRPs have received numerous Administrative Orders related to response activities at the Site. These Orders were summarized in section II B above. Discussions with PRPs regarding ROD implementation will not commence until issuance of this ROD completes the remedy selection process for this operable unit.

The PRPs have been active in the remedy selection process for the Site. Extensive legal and technical comments were submitted by the PRPs during the public comment period. These comments are included in the Administrative Record. EPA responses to the comments are included in the Responsiveness Summary (Appendix A).

III. COMMUNITY RELATIONS

There has been a great deal of community concern and involvement associated with this Site. EPA has kept the community and other interested parties apprised of Site activities through informational meetings, fact sheets, press releases and public meetings.

In April 1986, EPA released a community relations plan which outlined a program to address community concerns and keep citizens informed and involved in activities during remedial activities. In November 1986, EPA held a public meeting to present the results of the Remedial Investigation, Part I. In May 1988, EPA held an informational meeting to explain the Feasibility Study process and possible alternatives for remediation of the Site.

The Agency published a notice and brief analysis of the Proposed Plan in "The Daily Times Chronicle" on February 3, 1989, and made the plan available to the public at the Thompson Public Library in Woburn and at the headquarters of "For A Cleaner Environment," also located in Woburn.

On February 9, 1989, EPA held an informational meeting to discuss the results of the Supplemental Remedial Investigation, the cleanup alternatives presented in the Feasibility Study, and to present the Agency's Proposed Plan. During this meeting the Agency also answered questions from the public.

From February 10, 1989 to March 21, 1989, the Agency held a forty day public comment period to accept comments on the alternatives presented in the Feasibility Study, the Proposed Plan, and documents previously released to the public. On February 27, 1989, the Agency held a public meeting to accept oral comments. A transcript of this meeting, a summary of the comments received during the public comment period, and the Agency's responses to the comments are included in the Responsiveness Summary (Appendix A).

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The 330 acre Wells G & H Site consists of the unsaturated soils and aquifer associated with the five source areas of contamination and the central area surrounding Wells G & H, the Aberjona River, and associated wetlands (Figure 2). The remedy associated with this ROD will be conducted as the first operable unit and addresses remediation of contaminated groundwater, soil, and sludge found at the five properties identified as sources of contamination at the Site. The remedy also calls for a study of the central aquifer area to determine the most effective way of addressing contamination in the central area. EPA will address the cleanup of the central area of the Site, as well as the contamination found in the Aberjona River sediments, as a separate operable unit.

The overall response objective for the Site is to restore the entire aquifer to drinking water standards, i.e., the aquifer in the vicinity of both the source areas and the central area. The Agency believes, however, that the source areas of contamination contain the majority of the mass of contaminants at the site, and pose the principal threat at the Site. It is, therefore, appropriate to address the sources of contamination to the aquifer first, while continuing to evaluate other problems at the Site. This strategy will reduce the infiltration of volatile organics to the aquifer from the soil at the source areas, and will prevent further migration of contamination towards the central aquifer and off-site from the source areas. Therefore, cleanup as operable units is appropriate, and the remedial action associated with this operable unit is consistent with the overall response objective for the Site.

V. SITE CHARACTERISTICS

A complete discussion of Site characteristics can be found in the Remedial Investigations, Parts I, II, and the Supplemental RI Report. Chapter 1 of the Feasibility Study also contains an overview of the Remedial Investigations. The significant findings are summarized below.

A. Hydrogeologic setting

Groundwater in the study area occurs in two principal formations, the bedrock underlying the entire area, and the stratified drift which overlies bedrock in most of the study area. The two formations are separated in a few areas by a thin deposit of glacial till. The glacial till is exposed at land surface in the northeastern and southwestern parts of the study area. A peat deposit of variable thickness and extent overlies the stratified drift throughout most of the wetlands area.

The stratified drift is composed primarily of sand and gravel and yields the largest quantities of water in the area. Wells G & H are located in the stratified drift. Stratified drift deposits of up to 140 feet thick are found directly overlying the till and bedrock.

Recharge to stratified drift, till, and bedrock is from precipitation and periodically from the Aberjona River. The general direction of groundwater flow is from upland areas east, west, and north of the Aberjona River valley southward. The Aberjona River and its wetlands are a seasonal discharge area. Groundwater from the aquifer flows upward discharging into these surface water bodies.

The Aberjona River, which has its headwaters in Reading and empties into the Mystic Lakes in Winchester, flows north to south through the site. Relatively small amounts of groundwater enter the Aberjona River Valley from upgradient areas north of Interstate 95, and exit the narrow southern end of the valley south of Salem Street. A 38 acre wetland area exists on both sides of the Aberjona River in the center of the Site (see Figure 3). These wetlands are located within the 100-year floodplain of the Aberjona River.

River sediments are composed of silt and sand ranging in thickness from 0.5 to 2 feet and are underlain by peat averaging up to 7 feet in thickness. The peat, a relatively loose nearly saturated material, permits groundwater discharge to the river.

Water within the bedrock occurs in fractures and joints. Where fractures and joints are numerous, open, and well-connected, significant quantities of water may be obtained. The depth to bedrock from land surface ranges from zero, where bedrock is located on the surface at several locations along the eastern and western sides of the valley, to approximately 140 feet in the south central area of the valley. The primary axis of the bedrock valley is north-northwest/south-southeast, parallel to the orientation of the Aberjona River.

The pumping of Wells G & H and the Riley Tannery production well (Riley well) have influenced the movement of groundwater for much of the sites history.[2] Each generated a cone of influence which intercepted groundwater. When all wells were pumping, a groundwater divide was created between Wells G & H and the Riley well. This divide separated the groundwater flowing towards Wells G & H and the groundwater flowing towards the Riley well. This divide was located in the southwestern part of the Site. Further information is presented in the USGS aquifer test.

B. Groundwater Classification and Use

The Aberjona River aquifer, beneath and downgradient of the Site, is classified as Class I by the Commonwealth of Massachusetts (314 CMR §6.03). Class I aquifers are those groundwaters that are designated as a source of potable water supply.

Under the EPA Groundwater Classification System [EPA Groundwater Protection Strategy (GWPS), Office of Groundwater Protection, August 1984], this aquifer is classified as Class II B. Class II aquifers are aquifers that are currently used or potentially available for drinking water or other beneficial uses. Class II

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[2] The tannery ceased operations in January 1989.

A aquifers are those that are currently used, and Class II B aquifers are potential drinking water sources. The GWPS establishes groundwater protection goals based on the "highest beneficial uses to which groundwater having significant water resources value can presently or potentially be put." Guidelines for protection of aquifers are based on characteristics of vulnerability, use, and value.

The Aberjona River aquifer, in the vicinity of Wells G & H, can yield up to 2 million gallons of water a day. Although it was used in the 1960's and 70's as a supplemental water supply for Woburn, it is unusable for drinking water purposes in its present condition.

C. Contamination

1. Groundwater

Volatile organic compounds (VOCs) are the primary contaminants in the groundwater at the Site. Groundwater contamination has been found in the overburden and bedrock aquifers at the W.R. Grace & Company property, the Unifirst Corporation property, the Wildwood Conservation Corporation property, the New England Plastics Company property and the central area of the Site. In addition, groundwater contamination has been found in the overburden aquifer at the Olympia Nominee Trust property,

Plumes of VOCs in the overburden and bedrock groundwater extend from the W.R. Grace and Unifirst Corporation properties to Wells G & H. The W.R. Grace plume consists primarily of chlorinated solvents and is characterized by a high percentage of TCE and 1,2-Dichloroethene (DCE). Other contaminants include PCE and vinyl chloride. The Unifirst Corporation plume is characterized by a predominance of PCE. Secondary constituents are 1,1,1-TCA, and smaller amounts of TCE and DCE.

In addition, groundwater contamination was discovered beneath the Wildwood Conservation Corporation, the Olympia Nominee Trust and New England Plastics Corporation properties. The contamination at the Wildwood Corporation property consists primarily of TCE detected at a number of wells, with 1,1,1-TCA, DCE, and PCE detected at a few locations. At the Olympia property TCE and xylene were detected in the overburden. Concentrations of PCE, TCE, 1,1,1-TCA and DCE were found in both bedrock and overburden wells at the New England Plastics property.

2. Soil

Soil investigations were performed on several properties throughout the Site. VOCs are the primary contaminants in the soil at the Site and were found at various levels on the Wildwood

Corporation, Olympia Nominee Trust, W.R. Grace & Co., New England Plastics and Unifirst Corporation properties. Some soil contamination was found in a wetlands area on the Wildwood property.

Other contaminants found in soil include PCBs, chlordane (a pesticide), phthalates, and PAHs. These contaminants were found dispersed throughout the Wildwood property. PAHs were found in one location on the Olympia property. PCE and phthalates were found in a small area on the New England Plastics property. In addition, small quantities of sludge, contaminated with lead, VOCs, PAHs, pesticides, and assorted debris, was also found on the Wildwood property.

3. Sediment/River

Sediment samples taken from the Aberjona River, and along the banks of the Aberjona River in the wetlands, revealed contamination including PAHS and metals such as arsenic, mercury, and chromium. Surface water samples revealed low levels of VOCs.

4. Air

Air monitoring, conducted during all site investigations, did not reveal any readings above background at the breathing zone.

VI. SUMMARY OF SITE RISKS

An Endangerment Assessment (EA) was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants at the Site. Thirty-five contaminants of concern, listed in Table 1, were selected for evaluation in the EA. These contaminants constitute a representative subset of the total number of contaminants identified at the Site during the Remedial Investigation. The thirty-five contaminants were selected to represent potential on-site hazards based on their toxicity, concentration, frequency of detection, and mobility and persistence in the environment.

Potential human health effects associated with the contaminants of concern in groundwater, surface and subsurface soils, surface water, sediments, sludge, and air were estimated quantitatively through the development of several hypothetical exposure scenarios. The incremental lifetime cancer risks and the potential for noncarcinogenic adverse health effects were estimated for various exposure scenarios. Exposure scenarios were developed to reflect the potential for exposure to hazardous substances based on the characteristic uses and location of the Site. Factors of special note that are reflected in the EA are that the Site is a mixed use area which includes residences, commercial businesses and light industry, the aquifer was used at one time as a municipal drinking water supply, the aquifer is currently used to a limited degree for industrial process water, and that the Wildwood property is currently fenced and guarded.

For risk assessment purposes, individual contaminants are separated into categories of chemical toxicity depending on whether or not they exhibit carcinogenic effects. Carcinogenic risks are derived by multiplying the potency factor for a specific carcinogen, developed by EPA's Carcinogen Assessment Group, by its chronic daily intake (CDI). CDIs are the amount of a substance taken into the body per unit body weight per unit time. The product results in a number such as 1×10^{-4}. This number represents the probability that one out of ten thousand people will contract cancer as a result of exposure to a potential carcinogen. This number is then used by EPA to evaluate the risk associated with exposure to a contaminant under a particular exposure scenario.

Noncarcinogenic health risks posed by contaminants at a Superfund site are expressed via a hazard index. The hazard index is a term used to describe the ratio between the CDI and a relevant contaminant specific noncarcinogenic guideline such as the reference dose (RfD). This ratio (CDI:RfD) provides a measure of the potential for noncarcinogenic health effects to occur. When the hazard index is less than one, then adverse health effects from exposures attributed to the chemical(s) at the site are not anticipated.

A separate evaluation of risk was performed on each of the five source areas at the Site and the central area including the Aberjona River. This evaluation included selecting chemicals of potential concern on an area by area basis based on the presence of the chemical in background samples, the extent and magnitude of chemical contamination, chemical and physical properties affecting fate and transport of the chemical in the environment, and chemical toxicity. In addition, possible exposures to human and environmental populations were also examined. Table 2 summarizes the risks, by media, at the five source areas and the central area.

The greatest potential risks identified at the Site are attributed to future ingestion of contaminated groundwater, the inhalation of volatiles while showering, and exposure to surface soils through dermal contact and incidental ingestion. Other potential exposures include the inhalation of dust generated by site activities, the inhalation of volatiles released from the groundwater during industrial processes, and exposure to surface water and sediments from the Aberjona River through ingestion or dermal contact.

A comparison was made of all pathways of exposure for each of the contaminants of concern at each property at the Site to determine which chemicals presented the greatest risks. It was found that the same group of chemicals posed a risk at most, if not all, of the properties. The chemicals contributing the greatest carcinogenic risk under the groundwater exposure scenarios are vinyl chloride, 1,1-Dichloroethene, TCE, PCE, 1,1-Dichloroethane, chloroform, and 1,2-Dichloroethane. The chemicals contributing the greatest carcinogenic risk under the surface soil exposure scenarios are chlordane, chloroform, 4,4'-DDT, carcinogenic PAHs, PCBs, TCE, and PCE. The hazard index for noncarcinogenic risks exceeded one in surface soils for trans-1,2-Dichloroethene, 1,1,1-TCA and lead. The hazard index exceeded one in groundwater for trans-1,2-Dichloroethene, PCE and 1,1,1-TCA.

The results of the EA were used to assist EPA in developing response objectives for the Site and in setting cleanup goals for those chemicals which posed the greatest threat to human health and the environment. The response objectives, as well as the cleanup goals selected for the soil and groundwater contaminants listed above, are further discussed under Section X. A detailed discussion of Site risks can be found in the EA.

VII. DOCUMENTATION OF SIGNIFICANT CHANGES

EPA published a Proposed Plan for remediation of the Site on February 9, 1989. The two-part cleanup plan consisted of a source control remedy and a management of migration remedy. The source control portion of the plan included alternatives for the treatment of contaminated soils. The preferred source control alternative consisted of the treatment of soils contaminated with volatiles using in-situ volatilization, and the incineration of soils contaminated with PCBs, PAHs, and pesticides. The management of migration portion of the plan covered alternatives for the treatment of contaminated groundwater. The preferred management of migration alternative included the extraction of groundwater from the five source areas of contamination and the center of the Site. The groundwater would be pumped to a central treatment facility where it would be pretreated for metals, and then sent through an air stripper and vapor phase carbon filter for removal of volatile organic contamination.

The remedy selected in this ROD adopts the same source control component that was presented in the Proposed Plan. For the management of migration component, however, this ROD contains the following changes:

- Extraction of groundwater will still occur on all five source areas of contamination as stated in the preferred alternative section of the Proposed Plan, but the groundwater will be treated at individual treatment plants as opposed to one central treatment plant.

- Groundwater will not be extracted from the central area aquifer at this time. Rather, a study of the central area will be conducted to select the best remedial alternative for addressing contaminated groundwater in that area. The objectives of the study are delineated in Section X of this ROD. The study will be developed and implemented during the predesign phase of the remedy selected under this ROD. As discussed in Section IV of this ROD, the central area will be addressed as a separate operable unit and the remedy will be selected in a separate decision document.

- It is no longer necessary for the Riley Tannery production well to be pumped in an effort to maintain the southern boundary of the Site as was stated in the Proposed Plan.

- Treatment technologies other than air stripping may be considered for implementation of the groundwater remedy if they can be demonstrated to be equally or more effective.

Each of the changes listed above will be discussed in turn in the remainder of this section.

EPA received strong opposition from both the public and the PRPs to a central treatment facility. Many of the comments received concern the fact that construction of a single central treatment facility would require that pipes be placed in a wetlands area, and that contaminated water be moved across uncontaminated areas of the Site. In addition, some commenters felt that a single treatment plant would rule out the possibility of using different treatment options to address unique chemical combinations and concentrations found at individual source areas. These comments are further described in the attached Responsiveness Summary (Appendix A).

The Agency believes that the comments regarding these issues raise valid concerns, and that the overall protectiveness and effectiveness of the remedy will not be compromised by using individual treatment plants at the source areas of contamination. Therefore, in response to the public's comments, the Agency has decided to deviate from the originally preferred alternative in favor of a remedy which employs individual source area treatment plants.

In addition, many individuals raised issues during the public comment period which challenged the effectiveness and protectiveness of extracting groundwater from the central area. While it is the Agency's intent to address the contamination in the central area aquifer, EPA does see merit in further evaluating options for remediating this area while implementing the source area cleanup. Therefore, the Agency has decided to refrain from making a decision on the remedy for the central area until the concerns raised during the comment period can be more fully evaluated.

As mentioned above, the Agency has decided to address the central area as a separate operable unit. EPA believes that this approach is environmentally sound and logical for several reasons: the majority of contamination at the site is associated with the source areas; cleanup of these areas will prevent further migration of contaminants into the central area, and further migration of contaminants off-site from the source areas; and further evaluation of the central area will ensure that the eventual central area cleanup will be protective and effective.

Since completion of the Feasibility Study for this Site the Riley Tannery production well has ceased operation. The Proposed Plan called for pumping of the Riley well in conjunction with the central aquifer extraction system. This measure was intended to create a groundwater barrier that would prevent water from outside of the southern hydraulic boundary of the Site from being drawn into the central area. As the cleanup of the central area will be addressed as a separate operable unit, the maintenance of the Southern hydraulic boundary is no longer critical. Accordingly, the selected remedy provides simply that pump rates and well locations be determined that will capture the contamination associated with each individual property, and reduce the capture of contamination from other properties. The exact pumping rates and well locations to best accomplish this objective will be determined during remedial design.

During the public comment period, the Agency considered comments regarding the engineering advantages of employing individualized treatment processes at the source areas. EPA concurs that technologies in addition to air stripping may be appropriate for use at certain areas. Therefore, during remedial design EPA will consider proposals for the use of alternative treatment technologies which were evaluated in the Feasibility Study for groundwater remediation. It must be demonstrated that the proposed technology is equally or more effective than air stripping. In addition, treatment technologies other than those evaluated in the Feasibility Study may be considered by EPA subject to public comment.

As a result of the changes outlined above the Agency now supports a different management of migration (MOM) alternative than was presented in the Proposed Plan. The preferred MOM alternative has changed from MOM-4 (Pump and Treat Source Areas and the Central Area) to MOM-2 (Pump and Treat Source Areas). The MOM-2 alternative will be supplemented by a study of the central area to determine the most appropriate method of addressing groundwater contamination in that area, as well as an investigation of contamination in the Aberjona River. The reader is referred to Section IX for an analysis of the alternatives that were presented in the Feasibility Study, and to Section X for the rationale for selection of the selected alternative.

The Agency does not believe that it is necessary to reissue the Proposed Plan for further comment and provides the following rationale: because the Feasibility Study (FS) and the Proposed Plan discussed the alternatives of using separate treatment facilities at the source areas, and of proceeding with source area treatment only, the public already had an opportunity to comment on these alternatives; the suggested changes, including the potential use of an alternative groundwater treatment technology which was evaluated in the FS, do not alter the overall remedial objectives for the Site (presented in Section VIII); and the eventual proposal for remediation of the central area, as well as any proposal for use of a groundwater treatment technology that was not evaluated in the FS, will be subject to public comment.

VIII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Prior to the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA), actions taken in response to releases of hazardous substances were conducted in accordance with CERCLA as enacted in 1980 and the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, dated November 20, 1985. Although EPA proposed revisions on December 21, 1988 to the NCP to reflect SARA, until those proposed revisions are finalized, the procedures and standards for responding to releases of hazardous substances, pollutants and contaminants shall be in accordance with Section 121 of CERCLA, and to the maximum extent practicable, the current NCP.

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with applicable or relevant and appropriate requirements (ARARs) established under federal and state environmental laws unless a statutory waiver is warranted and justified in the ROD; a requirement that EPA select a remedial action that is cost effective and that uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a statutory preference for remedies that permanently and significantly reduce the volume, toxicity or mobility of hazardous substances over remedies that do not achieve such results through treatment. Response alternatives were developed to be consistent with these Congressional mandates.

A number of potential exposure pathways were analyzed for risk and threats to public health and the environment in the Endangerment Assessment and the Wetlands Assessment. Guidelines were used to assist EPA in the development of response actions including the Superfund Public Health Evaluation Manual (EPA, 1986) and the Draft Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites, October 1986 and April 1988. As a result of these assessments, EPA identified several objectives for the cleanup of the Wells G & H Superfund Site. These objectives were developed to mitigate existing and future threats to public health and the environment. The response objectives listed here are the overall objectives for the entire Site including the central area, the five source areas of contamination, the Aberjona River and its associated wetlands within the Site boundary. The specific response objectives for the operable unit associated with this ROD - the five source areas of contamination - are listed in Section X, part A. The response objectives for the entire Site cleanup, at the completion of all operable units, are as follows:

1. Restore the aquifer that supplied water to Wells G & H to drinking water standards.

2. Stop the introduction of contaminated groundwater from the source areas to the rest of the aquifer.

3. Stop the leaching of soil contaminants to the groundwater.

4. Prevent public contact with contaminated groundwater and soil above the cleanup levels.

5. Protect the natural resources in the area, such as the river and wetlands, from becoming further degraded.

6. Reduce further migration of contaminated groundwater off-site.

B. Technology and Alternative Development and Screening

CERCLA, the NCP, and EPA guidance documents including, "Guidance on Feasibility Studies Under CERCLA" dated June 1985, and the "Interim Guidance on Superfund Selection of Remedy" [EPA Office of Solid Waste and Emergency Response (OSWER)], Directive No. 9355.0-19 (December 24, 1986) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements and guidance documents, a range of treatment alternatives were developed for the Site ranging from an alternative that, to the extent possible, would eliminate the need for long term management at the Site (including monitoring), to alternatives involving treatment that would reduce the mobility, toxicity, or volume of the hazardous substances as their principal element. In addition to the range of treatment alternatives, a containment option involving little or no treatment and a no action alternative were developed in accordance with Section 121 of CERCLA.

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. In addition to these factors and the other statutory directives of Section 121 of CERCLA, the evaluation and selection process was guided by the EPA document "Additional Interim Guidance for FY 87 Records of Decision" dated July 24, 1987. This document provides direction on the consideration of SARA cleanup standards and sets forth nine factors that EPA should consider in its evaluation and selection of remedial actions. The nine factors are:

1. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).
2. Long term Effectiveness and Permanence.
3. Reduction of Toxicity, Mobility or Volume.
4. Short term Effectiveness.
5. Implementability.
6. Cost.
7. Overall Protection of Human Health and the Environment.
8. Community Acceptance.
9. State Acceptance.

Section 2 of the Feasibility Study identified, assessed and screened technologies for both soil and groundwater remediation based on technical feasibility, implementability, effectiveness, and cost. The purpose of the initial screening process was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. These technologies were separated into source control (SC) and management of migration (MOM) alternatives. Each alternative was then evaluated and screened in Section 3 of the Feasibility Study. Section 3 of the Feasibility Study presented the remedial alternatives developed by combining the technologies that passed the previous screening process into the categories required by OSWER Directive No. 9355.0-19. A total of eleven SC alternatives and five MOM alternatives were evaluated and screened in Section 3. Of these, nine SC alternatives and four MOM alternatives were retained for detailed analysis in Section 4. Table 3 identifies the thirteen alternatives that were retained throughout the screening process.

IX. DESCRIPTION/SUMMARY OF THE ANALYSIS OF ALTERNATIVES

This section presents a narrative summary and brief evaluation of each alternative according to the evaluation criteria described above. A detailed tabular assessment of each alternative can be found in the Feasibility Study, Section 4, Tables 4-36 and 4-39.

A. Source Control (SC) Alternatives Analyzed

The source control alternatives analyzed for the Site include a limited action alternative, SC-1; on-site and off-site incineration alternatives, SC-3 and SC-4; on-site high temperature enhanced volatilization, SC-5; on-site supercritical fluid extraction, SC-7; on-site enhanced volatilization/incineration, SC-8; on-site enhanced volatilization/off-site incineration, SC-9; in-situ volatilization/on-site incineration, SC-10; and in-situ volatilization/off-site incineration, SC-11. These alternatives are described briefly below with approximate capital and present worth operation and maintenance costs.

SC-1
Limited Action

The limited action alternative entails leaving contaminants untreated on site, and monitoring contaminant concentrations every year for 30 years. EPA would conduct a more extensive review of the Site every five years to determine whether further remedial action is necessary to protect human health and the environment. The limited action alternative also involves limiting access to the Site, limiting Site use, and conducting public education programs to increase public awareness of the Site. Although it is expected that contamination will remain on site beyond 30 years, EPA's cost analysis is based upon a 30 year timeframe. SC-1 was referred to as a no-action alternative in the Feasibility Study and Proposed Plan.

Because this alternative would not involve disturbing the contaminated soil, other than to construct a fence, it provides short term effectiveness in protecting public health during implementation. In addition, little difficulty would be involved in the implementation of the tasks associated with this alternative and the work could be completed within a relatively short period of time. However, this alternative would require ongoing surveillance and maintenance to ensure long term effectiveness. This alternative would not involve removal or other on-site containment and treatment to reduce the toxicity, mobility, or volume of the contaminants. It would not, therefore, provide adequate protection of human health and the environment. This alternative does not comply with ARARs.

The no-action alternative (i.e., the baseline scenario presented and evaluated in the risk assessment) does not include activities to reduce the potential for exposure such as restrictions on site use and access. Since the limited action alternative, which includes institutional controls to limit site access and use, is not protective and does not attain ARARs, the no-action alternative, which is less protective than the limited use alternative, would also not be protective nor attain ARARs.

Total Capital and Operation and Maintenance Costs: $800,800

SC-3
Excavation/On-Site Incineration/Backfill On-Site

This alternative would involve excavating approximately 9,500 cubic yards (cy) of contaminated soil at the Site and treating the soil on-site in a mobile incinerator. The contaminated soil would be burned at very high temperatures. Because incineration will destroy virtually all of the organic contaminants in the soil, the treated soil can be backfilled.

This alternative would use treatment to reduce the toxicity, mobility and volume of contaminants and would achieve permanence by destroying the contaminants of concern. This would effectively reduce risks associated with the Site and adequately protect human health and the environment. While there is a potential for short term public health threats to workers and area residents during excavation, soil handling and incineration, risks would be minimized by the use of adequate preventive measures. All components of this alternative are well developed and commercially available. No long term management of treated soil would be required, nor would there be a need for future remedial actions. This alternative would, however, require excavation and placement of fill in a wetlands, and if it is determined that a practicable alternative exists, it would not meet the Federal Wetlands Protection ARARs.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 4 years
Estimated Time for On-Site Construction and Operation Only: 15 months
Total Costs: $7,500,000

SC-4
Excavation/Off-Site Incineration/Backfill with Clean Off-Site Soil

This alternative is similar to SC-3 except that contaminated soil would be transported to an off-site incineration facility for treatment, and the excavated area would be backfilled with clean off-site soil.

This alternative would meet the criteria in the same way as SC-3 with the following exceptions. While the components of this alternative are well developed and commercially available, the available capacity of off-site incineration facilities could be a potential problem since there are only a few currently in operation in the country. In addition, this alternative is more costly than SC-3.

Estimated Time for Completion Including Design, Bidding, and Construction and Operation: 3.5 years
Estimated Time for Construction and Operation Only: 15 months
Total Costs: $22,100,000

SC-5
Excavation/On-Site High Temperature Enhanced Volatilization/Backfill On-Site

This alternative involves excavating approximately 9,500 cy of contaminated soils and treating the soils in a mobile treatment unit by high temperature enhanced volatilization. High temperature enhanced volatilization is a type of thermal treatment process that involves mixing the contaminated soil with heated air. This causes the release and transfer of VOCs, PAHs, PCBs and chlordane from the soil to the air in the unit. The contaminants in the air are then destroyed afterwards in a burner. The treated soil would then be backfilled into the excavated areas.

While there is a potential for short term public health threats to workers and area residents during excavation, soil handling, and high temperature volatilization, risks would be minimized by the use of adequate preventive measures. All components of this alternative are well developed and commercially available. However, data is lacking with respect to the effectiveness of this technology to achieve target levels for chlordane and PAHs. While the technology would use treatment to reduce the toxicity, mobility and volume of contaminants at the Site, it is uncertain as to whether the technology can reduce the concentrations of all contaminants to their target levels. Therefore, institutional controls may need to be implemented to ensure the long term effectiveness of this alternative. Treatability studies would have to be done to confirm whether this process would meet target levels for all contaminants. As with SC-3 and SC-4, this alternative would require excavation and placement of fill in a wetlands area, and if it is determined that a practicable alternative exists, it would not meet the Federal Wetlands Protection ARARs.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 3 years
Estimated Time for On-Site Construction and Operation Only: 9 months
Total Costs: $6,600,000

SC-7

Excavation/On-Site Supercritical Fluid Extraction/Backfill On-Site

This alternative would use an innovative technology to treat approximately 9500 cy of contaminated soil. Contaminated soil from the Site would be excavated and mixed with water to create a slurry that can be pumped into a mobile on-site extractor unit. Liquified carbon dioxide introduced into the unit would work as a solvent, dissolving contaminants as it passes over the slurry in the extraction unit under elevated pressure. Treated soil would be backfilled to the excavated areas. The small quantity of extractant containing the contaminants stripped from the soils would be collected and shipped off-site to a commercial incineration facility.

This alternative would use treatment to reduce toxicity, mobility and volume of contaminants at the Site. Although currently in use to treat PCB laden oily wastewater and sludges from refinery industries, this technology has not been used on a large scale for removal of the kind of soil contamination present at the Site. Therefore, its ability to reduce contamination to target levels is uncertain, and institutional controls may need to be implemented to ensure the long term effectiveness of this alternative. Treatability studies would be necessary before supercritical fluids extraction could be implemented at the Site. In addition, because this is an innovative technology, we are uncertain of the availability of materials and services to implement this alternative. As with all other alternatives involving excavation and placement of fill in a wetlands, this alternative would not meet the Federal Wetlands Protection ARARs if it is determined that a practicable alternative exists.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 3.5 years
Estimated Time for Construction and Operation Only: 1 year
Total Costs: $7,500,000

SC-8
Excavation/On-Site Enhanced Volatilization/On-Site Incineration/Backfill On-Site

This alternative would use enhanced volatilization as described under SC-5, except at lower temperatures, to treat approximately 7,600 cy of soil contaminated with VOCs only, and on-site incineration in a mobile unit as described under SC-3 to treat approximately 1,900 cy of soil contaminated with a mixture of PAHs, PCBs, VOCs, and pesticides. Treated soil from both the enhanced volatilization and incinerator units would be backfilled on-site.

While there is a potential for short term public health threats to workers and area residents during excavation, enhanced volatilization, and incineration activities, risks would be minimized by the use of adequate preventive measures. All components of this alternative are well developed and commercially available. This combination would use treatment to reduce toxicity, mobility and volume of contaminants at the Site. Soil contaminants would be reduced to target levels by incineration in this alternative. However, the ability of enhanced volatilization to achieve target levels is uncertain, and institutional controls may need to be implemented to ensure the long term effectiveness of this alternative. Treatability studies would be required to confirm the long term effectiveness of enhanced volatilization with respect to achieving target levels. This alternative requires excavation and placement of fill in a wetlands. If it is determined that a practicable alternative exists, it would not meet the Federal Wetlands Protection ARARs.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 4 years
Estimated Time for Construction and Operation Only: 16 months
Total Costs: $6,200,000

SC-9
Excavation/On-Site Enhanced Volatilization/Off-Site Incineration/Backfill with Treated and Clean Off-Site Soil

This alternative differs from SC-8 only in that soils contaminated with a mixture of organic contaminants would be excavated, packaged and shipped off-site for incineration. Since only the soil treated by enhanced volatilization would remain on-site for use as a backfill, clean fill would have to be brought in to supplement the treated soils. This alternative would meet the criteria in the same way as SC-8 except that this alternative is more costly.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 3.5 years
Estimated Time for Construction and Operation Only: 10 months
Total Costs: $9,000,000

SC-10
In Situ Volatilization/Excavation/On-Site Incineration/Backfill On-Site

This alternative uses both in-situ volatilization and incineration to treat the contaminated soil on-site. In-situ volatilization would be used to treat 7600 cy of soil contaminated only with VOCs. This technology involves installing extraction wells into the contaminated soils above the groundwater table. Piping is attached to each well and also to a vacuum pump. The vacuum pump draws air from the surrounding soils into the wells without disturbing the soils. As the air passes over the contaminated soils, VOC contaminants are transferred from the soil to the air. The air is sent through columns of activated carbon that filter out the contaminants, and the treated air is discharged to the atmosphere. The carbon is then regenerated to remove contaminants. Incineration would be used to treat the remaining 1900 cy of soil at the Site contaminated with a mix of PCBs, PAHs, pesticides and VOCs.

While there is a potential for short term public health threats to workers and area residents during excavation, incineration, and in-situ volatilization, risks would be minimized by the use of adequate preventive measures. All components of this alternative are well developed. In-situ volatilization has been successfully used at a number of Superfund sites for VOC removal, and incineration technologies are demonstrated to be reliable. Pilot scale testing would be required for in-situ volatilization for full-scale design and optimization.

This alternative would effectively reduce the toxicity, mobility and volume of contaminants in the soil. This alternative would reduce contaminants to target levels. In addition, a portion of the soil to be treated by in-situ volatilization is located in a wetland area where the technology could be implemented without damaging the wetland. SC-10 would meet all Federal and State ARARs.

SC-10 is the chosen source control alternative for implementation at the Site. It is discussed in greater detail in Section X.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 4 years
Estimated Time for Construction and Operation Only: 16 months
Total Costs: $3,200,000

SC-11
In-Situ Volatilization/Excavation/Off-Site Incineration/Backfill With Clean Off-Site Soil

This alternative is similar to SC-10 except that the soil with mixed contaminants would be packaged and shipped off-site for incineration.

This alternative would meet the criteria in the same way as SC-10 except that this alternative is more costly.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 3.5 years
Estimated Time for Construction and Operation Only: 10 months
Total Costs: $6,200,000

B. Management of Migration (MOM) Alternatives Analyzed

The management of migration alternatives address contamination of the groundwater at the source areas and at the center of the Site. Contamination which exists in the overburden and bedrock aquifers of the source areas has migrated to the center of the Site. In addition, some groundwater contamination exists beyond the southern boundary of the Site. The MOM alternatives evaluated include a limited action alternative, MOM-1; pumping and treating the source areas, MOM-2; pumping and treating the central area, MOM-3; and pumping and treating both the source areas and the central area, MOM-4.

Section 4 of the Feasibility Study examines 11 variations of the three "pump and treat" MOM alternatives (see Table 3), all of which include three basic procedures: 1) the installation of wells to extract contaminated groundwater from the Site; 2) pretreatment of the extracted groundwater to remove suspended solids and metals that could potentially foul the principal treatment unit; and 3) a treatment scheme to remove VOCs from the groundwater. These 11 variations differ according to the location of the extraction well, the type of treatment scheme employed, and the location and number of treatment facilities.

The three different treatment schemes that were evaluated for the removal of VOCs include physical treatment by air stripping, chemical treatment by ultraviolet (UV)/chemical oxidation, and physical treatment by carbon adsorption. Below is a brief description of each technology.

Air Stripping: Extracted groundwater is first pretreated and then passed through an air stripping chamber which is encased in a cylindrical structure. In the chamber, air is forced up through the water. As a result, contaminants are carried into the air stream. The air stream is then treated in activated carbon columns to remove contaminants before being released to the atmosphere. Treated groundwater would then be discharged.

Ultraviolet (UV)/Chemical Oxidation: This technology uses a chemical reaction to destroy organic contaminants in the groundwater. Hydrogen peroxide would be introduced into the contaminated groundwater in the presence of ultraviolet light to create new compounds called hydrogen radicals. These radicals react to chemically alter organic contaminants to non-hazardous carbon dioxide and water.

Carbon Adsorption: This technology can be used as a principal or secondary treatment; either to remove organic contaminants from groundwater or to remove organics from the airstream. Activated carbon is carbon that has been treated to enhance properties that cause contaminants to adhere to the carbon surface areas. Groundwater is continuously pumped through the activated carbon units until cleanup goals are met. The carbon filter is regenerated from time to time to maintain its efficiency.

As stated earlier in this ROD, the Riley Tannery production well is no longer in use. The cleanup timeframes and approximate pump rates for the MOM alternatives were estimated based on the conditions that existed when the Riley well was pumping. The absence of the Riley well does not change the recommended pump rates as discussed in the Feasibility Study as these rates were developed excluding the effects of the Riley well. The absence of the Riley well, however, does impact the movement of contaminants into the central area and the timeframe associated with the cleanup of the central area. The Agency does not believe that these changes are significant since the central area is not being addressed under this ROD, and the objectives of remediating the five source areas are not modified by the fact that the Riley well is no longer pumping.

The following is a brief description of each of the MOM alternatives evaluated for the treatment of contaminated groundwater.

MOM-1
Limited Action

A limited action alternative for groundwater would consist of a long term monitoring program and review every five years to determine whether further remedial action is necessary to treat contaminated groundwater. The limited action alternative also involves limiting the withdrawal of groundwater and conducting educational programs to increase public awareness. Groundwater contamination, however, would remain and continue to migrate to other areas within the Site and downgradient from the Site. The actual time it would take for remediation to be accomplished, through natural attenuation, is greater than 100 years. Thirty years, however, is the estimate being used for costing purposes only. MOM-1 was referred to as a no-action alternative in the Feasibility Study and Proposed Plan.

This alternative poses no short term threat to the community as groundwater use would continue to be restricted. While workers at the site for sample collection and site inspection would be exposed to contaminated groundwater, risks would be minimized by the use of personal protective equipment. However, as this alternative contains no active remediation, it would not result in any immediate reduction in toxicity, mobility, or volume of contaminants, and would not result in the attainment of target cleanup levels in a rapid time frame. Also, the volume of contaminated groundwater would probably increase with time due to the migration of contaminants into other areas of the Site as well as into the deeper fractures in the bedrock. Therefore, this alternative will not provide long term effectiveness and permanence, and it is not protective of human health and the environment. Finally, this alternative does not comply with ARARs.

The no-action alternative (i.e., the baseline scenario presented and evaluated in the risk assessment) does not include activities to reduce the potential for exposure such as limiting groundwater withdrawal. Since the limited action alternative, which includes institutional controls to limit the withdrawal of groundwater for potable use, is not protective and does not attain ARARs, the no-action alternative, which is less protective than the limited use alternative, would also not be protective nor attain ARARs.

Total Costs: $440,200

MOM-2
Pump and Treat Source Areas

This alternative would involve pumping groundwater from each of the five source areas, pretreatment to remove suspended solids and metals, and treatment by either air stripping or ultraviolet (UV)/chemical oxidation to remove VOCs. Treatment by carbon adsorption alone was not evaluated for this alternative because of the superiority of air stripping and UV/chemical oxidation for removing higher levels of VOCs. Contaminated groundwater in the overburden aquifer would be pumped and treated at all of the properties. Contaminated groundwater in the bedrock would be pumped and treated at all properties except Olympia Nominee Trust. Contaminated groundwater would be treated at either separate source area treatment plants or one centrally located treatment plant. Source areas would be pumped with the objective of achieving MCLs.

Under this alternative, potential public health threats would exist for area residents and workers during construction, but would be minimized by the use of adequate preventive measures. Eventually, contamination in the groundwater would be reduced to target levels throughout the Site. Although MOM-2 does not directly address the central area of the Site, it was anticipated, at the time the Feasibility Study was conducted, that pumping at the Riley well and natural attenuation would remediate the central area to MCLs over a period of 22 years. A small portion of contaminated groundwater may migrate off-site.

The extraction at source areas would control the migration of contaminated groundwater to the central area and beyond, thereby preventing further contamination of the aquifer. Also, treatment would directly reduce the toxicity, mobility and volume of contaminants in the groundwater. The effectiveness of extraction of contaminated groundwater from the fractured bedrock is uncertain, however, and some residual contamination could remain in the bedrock. Finally, this alternative would comply with ARARs.

MOM-2 is the chosen management of migration alternative for implementation at the Site and is discussed in greater detail in Section X.

Estimated Time for Completion Including Design, Bidding, Construction, and Operation: 22 years for central area; 20-50 years for source areas.
Total Costs: The cost for implementing this alternative will depend on the number and type of treatment plants selected for the remedy. See Table 4 for a breakdown of costs for each variation.

MOM-3
Pump and Treat Central Area

This alternative involves pumping contaminated groundwater from the central area of the site followed by pretreatment and either air stripping, UV/chemical oxidation, or carbon adsorption. This alternative would significantly reduce migration of contaminants off-site to the south due to the large capture zone for Wells G & H. However, contaminated groundwater in source areas could migrate off-site.

Potential public health threats to area residents and workers during construction would exist from direct contact with contaminated groundwater, soils and inhalation of fugitive dust and organic vapors. These risks, however, could be minimized by using preventive measures and personal protective equipment.

This alternative would capture contaminated groundwater from the central area, and would also intercept a limited amount of contaminated groundwater that flows from the source areas to the central area. Since no direct bedrock pumping at the sources would occur, some contaminated groundwater may remain in the bedrock at the source areas and continue to recontaminate the overburden in the future. As the achievement of MCLs throughout the site is anticipated to require in excess of 60 years, this alternative would result in protection of human health and the environment only after a lengthy remediation period. This alternative will meet ARARs throughout the Site, although there is more uncertainty that ARARs can be met in the bedrock.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: Exceeds 60 years
Total Costs: See Table 4

MOM-4
Pump and Treat Source Areas and the Central Area

This alternative combines MOM-2 and MOM-3 to provide pumping and treatment of contaminated groundwater from the source areas and the center of the Site. Treatment of groundwater would occur at either six separate treatment plants or at one centrally located treatment plant. Groundwater would first be pretreated and then principally treated by either an air stripper or by UV/chemical oxidation. Treatment by carbon adsorption alone was not evaluated for this alternative because of the superiority of the other two treatment processes for removing higher levels of VOCs.

The extraction of contaminated groundwater at the source areas and central area followed by pretreatment and air stripping would significantly reduce the migration of contaminants from source areas as well as the central area. The source areas and central area would be pumped with the objective of achieving MCLs throughout the Site. The effectiveness of extraction of contaminated groundwater from the fractured bedrock is uncertain, however, and some residual contamination could remain in the bedrock in the source areas.

Potential public health threats to area residents and workers during construction would exist from direct contact with contaminated groundwater, soils and inhalation of fugitive dust and organic vapors. These risks, however, could be minimized by using preventive measures and personal protective equipment. This alternative would result in overall protection of human health and the environment upon completion of remediation. MOM-4 would comply with ARARs.

Estimated Time for Completion Including Design, Bidding, Construction and Operation: 10 years for the central area, 20-50 years for the source areas.
Total Costs: See Table 4

X. THE SELECTED REMEDY

The remedial action selected for implementation at the Wells G & H Site consists of the source control alternative SC-10, and the management of migration alternative MOM-2. The operable unit addressed by this ROD includes the five identified source areas of contamination. In addition, the remedial action also includes a study of the central area to determine the most effective remedial alternative for restoring the central area aquifer to drinking water quality, as well as an investigation to identify the extent of contamination in the Aberjona River.

A. Description of the Selected Remedy

1. Remedial Action Objectives/Cleanup Goals

The selected remedy was developed to satisfy the following remedial objectives which will guide the design of the remedy and be used to measure the success of the remedy. The objectives listed below are specific to the operable unit described in this ROD.

a. Soil

The remedial objectives for contaminated soil at the five source areas of contamination at the Wells G & H site are as follows:

- Prevent public contact with contaminated soil above the Cleanup levels;
- Stop the leaching of soil contaminants to the ground water; and
- Protect the natural resources at the site from further degradation.

EPA has identified site-wide cleanup goals for each of the chemicals of concern in soil. These goals satisfy the above objectives. The soil cleanup goals represent the concentrations that can remain in the soil and still be considered protective of public health. Three approaches were used to determine these levels. For volatile organic compounds detected in the soil and the groundwater, and which pose a substantial risk from exposure via groundwater, a leaching model was used to calculate a level in the soil that is protective of groundwater. These chemicals and their respective target soil concentrations are presented in Table 5.

The second approach involved developing soil cleanup goals for PCBs, PAHs, and the pesticides chlordane and DDT. Consistent with the Superfund Public Health Evaluation Manual, 1986, EPA evaluated a risk range of 10^{-4} to 10^{-7} individual lifetime excess cancer risks associated with direct contact with the contaminants in the soil. The soil cleanup levels corresponding with a 10^{-6} increase in potential excess cancer risk were chosen for these contaminants. These chemicals and their respective target soil concentrations are presented in Table 6.

The third approach develops a cleanup goal for lead based on acceptable blood lead levels. The chosen cleanup goal for lead in soil, based on a target blood lead level of 10 ug/dl, is 640 mg/kg. The methodologies used to derive the cleanup goals for each of the three approaches presented above are discussed in detail in the Feasibility Study, Section 1.

b. Groundwater

The remedial objectives for contaminated groundwater at the five source areas of contamination at the Wells G & H Site are as follows:

- Prevent the further introduction of contaminated ground water from the source areas to the central area;
- Limit the further migration of contaminated ground water off-site from the source areas;
- Restore the bedrock and overburden aquifers (aquifers) in the vicinity of the source areas to drinking water quality; and
- Prevent public contact with contaminated groundwater above the cleanup levels.

The target groundwater cleanup levels are based upon the classification of the groundwater at the Site as a potential source of drinking water. Therefore, EPA has identified Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act as the cleanup goals to be applied to the Site groundwater within the aquifer. These goals satisfy the above objectives and are protective of human health and the environment. Table 7 presents the cleanup goals for the chemicals of concern in groundwater.

Cleanup goals for treated groundwater effluent will depend on the point of discharge. Presently, EPA believes that treated groundwater will be discharged to the Aberjona River. In this case, the Massachusetts Ambient Water Quality Standards (AWQSs) will be used to set effluent targets. If the effluent is discharged to the aquifer, MCLs will be the appropriate standards. Specific effluent discharge requirements will be refined during design.

2. Description of Remedial Components

The following components define the selected remedy. This remedy addresses groundwater, soil, sludge and debris at the Site.

a. Contaminated Soil Treatment

This component of the remedy is composed of the following: in-situ volatilization, excavation, on-site incineration, backfilling, predesign work, implementation monitoring, and completion requirements.

Incineration will be used to treat approximately 2100 cy of soil at the Site contaminated with a mix of PCBs, PAHs, pesticides and VOCs. These soils will be excavated from the Wildwood, Unifirst Corporation, New England Plastics Company and Olympia Nominee Trust properties and then destroyed in a mobile temporary on-site incinerator. The incinerator will employ Best Available Control Technology, such as air scrubbers, and will be monitored to control air emissions. Test burns will be required to determine actual performance of incineration on the mixed contaminant soil and to generate treated samples for EP toxicity and TCLP tests to confirm that the treated soil would be acceptable for backfill at the site. If EPA determines that the incinerator ash is subject to the Land Disposal Restrictions of the Resource Conservation and Recovery Act (RCRA), the ash will be managed in accordance with such restrictions. After the soil has been treated and tested, and it is determined to meet cleanup goals, it will be used as backfill for excavated areas.

In-situ volatilization will be used to treat approximately 7400 cubic yards of VOC contaminated soil on the Wildwood property. A portion of the soil to be treated by in-situ volatilization is located in a wetland area on the Wildwood property. The in-situ volatilization system will be installed in such a way that it minimizes damage to the wetland. In-situ treatment will use carbon adsorption for vapor treatment. Pilot scale testing will be required to ensure full scale design and optimization.

The areas of contaminated soils at the Site are identified in Figure 4. There was no soil found at the W.R. Grace property in concentrations above the target cleanup levels. Consequently, there is no soil removal prescribed for the W.R. Grace property. Following are approximate volumes of contaminated soils per property. The methodology used to estimate these volumes is presented in Appendix D and Section 3.1 of the Feasibility Study.

Wildwood - 7400 cubic yards of VOC contaminated soil and 1900 cubic yards of mixed contaminant soil.

Olympia - 5 cubic yards of PAH contaminated soil.

New England Plastics - 40 cubic yards of VOC contaminated soil.

Unifirst - 150 cubic yards of VOC contaminated soil.

Requirements of predesign will include soil sampling to refine estimates of contaminated soil volumes and to generate property specific values for the fraction of organic carbon in the soil. This information will be used to modify soil volumes and soil cleanup goals as necessary. VOCs are the primary soil contaminant at the Site. The volume of VOC contaminated soil requiring remediation is largely determined by the target cleanup levels for VOCs. These levels are based on the leaching model discussed in Section X.A.1.a above and presented in Section 1.0 of the Feasibility Study. As the soil fraction of organic carbon is a component of that model, a variation in this number may necessitate refinement of the cleanup goals for VOCs in soil. A value of 1% for the fraction of organic carbon in soil was used to generate the approximate volumes of contaminated soil per property listed above. That value was assumed based on the soil types present. Any refinement of the cleanup goals based on the fraction of organic carbon value will be made in accordance with the leaching model.

Air monitoring will be performed during the implementation of the remedy to ensure that fugitive and point source emissions do not result in unacceptable ambient air quality. Consideration will be given to the sequencing of the soil and groundwater components of the remedy to avoid recontamination of treated soil by volatilization of contaminated groundwater. This is of special interest at the Unifirst property due to the presence of dense non-aqueous phase liquids which have the potential to volatilize and recontaminate the soils. In addition, wetlands monitoring will occur to avoid degradation of the wetlands.

A soil sampling and analysis program will be implemented to monitor the performance of in-situ volatilization. At a minimum, it will include soil and soil gas sampling at the beginning, during, and end of implementation. Soil samples will also be taken during excavation for the incineration component of this remedy in order to refine the extent of soil for removal. Upon completion of the excavation and in-situ volatilization programs, soil samples will be taken and evaluated against cleanup goals. This data will be used to evaluate the success of the remedy, and ultimately for site delisting. A specific soil sampling and analysis program will be developed during design.

b. Sludge and Debris Disposal

A specific program for the removal and disposal of sludge and debris from the Wildwood property will be defined during design.

This material does not lend itself to on-site incineration due to its metal content. If EPA determines that this material is subject to the Land Disposal Restrictions of RCRA, it will be managed in accordance with such restrictions. If the material is not subject to the Land Disposal Restrictions of RCRA, it will be removed by a licensed waste hauler for appropriate disposal. Upon completion of removal, soil samples will be taken and evaluated against ROD soil cleanup goals to determine the need for additional excavation or treatment.

c. Ground Water Extraction and Treatment

This component of the remedy consists of the following: construction of groundwater treatment plants, predesign pump tests and bench tests, development of extraction and monitoring wells, groundwater treatment, groundwater monitoring, and effluent monitoring.

Ground water extraction and treatment systems are to be implemented at each source area. As the location and type of contamination may vary among the source areas, each system will be designed to address the bedrock and/or overburden contamination associated with a particular area. Following are approximate pumping rates used in the Feasibility Study for comparison purposes. The methodology used to estimate the pump rates is presented in Section 3.2 and Appendix C of the Feasibility Study. The exact number, location, depth, and pumping rate of extraction wells at each source area will be developed during remedial design.

W.R. Grace - 45 gallons per minute (gpm) in the overburden, 20 gpm in the bedrock.

Unifirst - 60 gpm in the overburden, 20 gpm in the bedrock.

Olympia - 50 gpm in the overburden.

Wildwood - 240 gpm in the overburden, 60 gpm in the bedrock.

New England Plastics - 15 gpm in the overburden, 6 gpm in the bedrock.

The proposed groundwater treatment system consists of pretreatment by precipitation, coagulation, flocculation, and clarification to remove suspended solids and metals followed by air stripping to remove VOCs. Pretreatment sludge will be disposed of at a licensed facility. The sludge will be tested to determine if it is subject to the RCRA Land Disposal Restrictions. If EPA determines that the sludge is subject to such restrictions, it will be managed accordingly.

Carbon adsorption will be used to treat emissions from the air stripper in order to comply with the Massachusetts Air Pollution

Control requirements to use Best Demonstrated Available Technology for point source emissions (310 CMR § 7.00). Treated groundwater will be discharged to the Aberjona River, reinjected into the aquifer, or both, depending on design. Given that each source area is unique in regard to its contaminants, EPA will consider alternative treatment approaches that can be demonstrated to be equally or more effective in contaminant removal as the presented system.

The approximate area of groundwater contamination associated with each source area is defined in Figure 5. This figure delineates approximate boundaries for groundwater extraction that will be refined during design.

Predesign work will consist of pump tests, groundwater sampling, and bench and pilot testing of the presented and/or proposed treatment technologies. Pump tests will be performed to determine well yields. This information will be used to help determine pumping rates and the location and number of extraction wells. Groundwater sampling will occur at each source area to refine and confirm the nature and extent of contamination in both the bedrock and overburden. Bench scale treatability studies will be performed for the presented and/or proposed treatment technology employed at each source area.

Groundwater monitoring of the overburden and bedrock aquifers will occur during implementation of the remedy in order to determine compliance with the cleanup goals. A specific monitoring program will be developed during design and will include, at a minimum, overburden and bedrock monitoring wells at each source area including those wells that have been installed as part of the remedial investigation. Monitoring wells will be sampled at least quarterly. In addition, pumping rates at each extraction well will be monitored. Treatment system influent and effluent concentrations will be monitored at a minimum of once per day. The objectives of monitoring are to define the mass of contaminants extracted over the life of the remedy, to evaluate the efficiency of the remedy, and to ensure compliance with appropriate Federal and State requirements.

In addition to the monitoring program, a summary report will be generated yearly during the implementation of the remedy. The report will summarize the status of groundwater remediation and, at a minimum, will include the following: summary tables of contaminant concentrations; a summary of the mass of contaminants removed, i.e., groundwater pump rates and the influent and effluent concentrations; contour maps of the distribution of contaminants; and an interpretation of the trends in contaminant concentration and distribution.

Once cleanup goals have been satisfied, the extraction wells will be shut down and a monitoring program will be implemented. This program will consist of a minimum of three years of quarterly monitoring of ground water quality. If the monitoring data during this period shows an increase in contaminant levels over time, such that cleanup goals are not maintained, active groundwater remediation will be resumed. The results of this monitoring program will be reviewed by EPA in order to evaluate the success of the remedy, the maintenance of cleanup goals, the need for any additional site work including the resumption of the remedy or the implementation of institutional controls, and to provide information for site delisting.

d. Institutional Controls

EPA recommends that the State and the City of Woburn implement controls, such as regulations, ordinances, deed and land restrictions, or other effective forms of land use control to prevent the use of the aquifer in the vicinity of the Site. Groundwater use should be restricted until it is determined conclusively that cleanup goals have been met.

e. Central Aquifer/Aberjona River Study

EPA's objective is to restore the central area aquifers to drinking water quality. This study is being pursued in part in response to the number of commenters who have questioned whether or not this objective is feasible. The objectives of the study were developed in order to investigate more fully the concerns that were raised during the public comment period. They include, but are not limited to, the following:

- Define the nature and extent of contamination in the Aberjona River.
- Define the upgradient introduction of contaminants to the Aberjona River.
- Refine the present understanding of the interaction of the Aberjona River and the aquifer systems on the Site.
- Evaluate the effectiveness of pump and treat as a remedial alternative for the cleanup of contaminated groundwater in the central area.
- Evaluate the impact of pumping the central aquifer on the Aberjona River and associated wetlands.
- Identify and evaluate innovative remedial technologies for aquifer restoration, e.g., in-situ bioremediation.
- Evaluate the mobility of contaminants including semi-volatile organics and metals under ambient and pumping conditions.

This study will be developed and implemented during the predesign portion of the remedy. The central aquifer and the Aberjona River will be addressed as a separate operable unit and the remedy for the central area and the Aberjona River will be selected in a separate decision document.

B. Rationale for Selection

The rationale for choosing the selected alternative is based on the assessment of each criteria listed in Section VIII, Part B. In accordance with Section 121 of CERCLA, to be considered as a candidate for selection in the ROD, the alternative must have been found to be protective of human health and the environment and able to attain ARARs unless a waiver is granted. In assessing the alternatives that met these statutory requirements, EPA focused on the other evaluation criteria, including, short term effectiveness, long term effectiveness, implementability, use of treatment to permanently reduce the mobility, toxicity and volume, and cost. EPA also considered nontechnical factors that affect the implementability of a remedy such as state and community acceptance. Based upon this assessment, and taking into account the statutory preferences under CERCLA, and public comment on the Proposed Plan, EPA selected the remedial approach for the first operable unit at the Site.

1. Source Control

The selected source control remedy, SC-10, as well as SC-3, 4, and 11, reduces risks to human health and the environment by reducing VOCs, PCBs, PAHs, pesticides, and lead in soil and sludge to cleanup goals. The limited action soil alternative, SC-1, is not protective of human health and the environment. Because soil alternatives SC-5, 7, 8, and 9 may require the use of institutional controls to provide protection of human health and the environment, there is greater uncertainty as to their long term effectiveness and permanence.

SC-3, 4, 10 and 11 reduce risks to human health and the environment through complete destruction of the contamination, and result in a permanent, protective cleanup that requires no long term management after cleanup goals are reached. The long term effectiveness of soil alternatives SC-5, 7, 8, and 9 is less certain as they may require the use of institutional controls, such as access restrictions, to achieve protection if cleanup goals cannot be met. SC-1 does not provide reliable protection, does not meet cleanup goals, and is not a permanent remedy.

SC-10 and 11 use treatment to permanently reduce the level of toxicity of the contaminants at the Site, to prevent the potential for contaminants to move away from the source, and to reduce the volume, or amount, of contamination at the Site. SC-1 would not treat or destroy any of the contaminated soil exceeding target levels and therefore would not achieve any reduction in toxicity, mobility or volume. For all other source control alternatives, except for SC-3 and 4, there is greater uncertainty as to their ability to achieve the target levels for all contaminants.

All alternatives except SC-1 pose short term impacts due to excavation activities which require dust control to protect workers and the community. The alternatives that include in-situ volatilization, SC-10 and 11, have fewer adverse effects since they only require excavation of the mixed contaminant areas.

SC-1 is easily implemented since it does not involve any soil excavation or treatment. All other alternatives are feasible and readily available technologies with the exception of SC-7 which is an innovative technology and is not readily available. The most proven and commonly used alternative is incineration (SC-3 and 4). The enhanced volatilization (SC-8 and 9) and high temperature enhanced volatilization (SC-5) technologies have been used to a lesser extent. The in-situ volatilization process (SC-10 and 11) has been used successfully at a number of sites to treat volatile organics in soil to concentrations in the range of the proposed soil target levels. There is less certainty that alternatives SC-5, 7, 8, and 9 can achieve the target levels in soil.

All of the technologies except for SC-7 are available in mobile transportable units which can be transported to the Site. There is some uncertainty associated with the availability of capacity of off-site permitted commercial incineration facilities (SC-4, 9, and 11) and therefore the implementability of these alternatives is less certain.

Other than SC-1, SC-10 and 11 are likely to result in the least adverse impacts on wetlands since excavation is minimized. All other alternatives (SC-3, 4, 5, 7, 8, and 9) require excavation and filling of wetlands. Because there is a practicable alternative to construction in the wetlands area, and this alternative satisfies the other evaluation criteria, SC-3, 4, 5, 7, 8, and 9 would not meet the Wetlands Executive Order. In addition, under the Massachusetts Wetlands Protection Act all alternatives except for SC-10 and 11 require replication of the wetlands that are lost due to excavation. This is expected to be difficult to do.

Alternative SC-4, off-site incineration, is the most expensive remedial alternative at approximately $22 million (see Table 12). In general, none of the alternatives involving off-site incineration (SC-4, 9, and 11) would be considered cost effective as they are substantially more expensive than their on-site counterparts and offer no additional reduction of risk to human health and the environment. SC-10, the chosen source control alternative, is the least expensive alternative that will achieve cleanup goals.

2. Management of Migration

The management of migration portion of the remedial action is designed primarily to reduce the volatile organic contamination in the overburden and/or bedrock aquifers of the five source areas of contamination at the Site to drinking water standards as quickly as possible. It is also designed to prevent off-site migration of contaminants from the source areas.

Section VII, Documentation of Significant Changes, presents the Agency's rationale for deciding to approach the cleanup of the Site through the implementation of operable units. This ROD addresses the first operable unit of the Site, the five source areas of contamination. The central area and the Aberjona River will be addressed as a separate operable unit. Accordingly, evaluation of the alternatives addressing the central area, i.e., MOM-3 (Pump and Treat Central Area), and MOM-4 (Pump and Treat Source Areas and Central Area), is not appropriate for this first operable unit. Alternatives for the central area aquifer cleanup will be evaluated and addressed in a separate decision document following the completion of further investigation of this area. Therefore, the following discussion simply compares the MOM-1 alternative (Limited Action) to the various treatment options evaluated for the MOM-2 alternative (Pump and Treat Source Areas).

The selected management of migration remedy MOM-2, including pretreatment and air stripping at separate treatment plants, will reduce risks to human health and the environment by reducing VOC contamination in the bedrock and overburden groundwater. While the source areas will be pumped with the objective of achieving MCLs there is some uncertainty in how effective the bedrock remediation will be. Therefore, some residual bedrock contamination may remain after the remediation period (see discussion of groundwater cleanup goals Section X.A.1.b). MOM-1 provides minimal protection of human health and the environment by monitoring the contaminant migration downgradient of the Site.

For alternative MOM-1, although use of the aquifer would continue to be restricted, the future risk of exposure to groundwater contamination remains. MOM-2 would permanently reduce contamination at the source areas.

MOM-2 will significantly reduce the toxicity, mobility, and volume of contaminants in the groundwater at the source areas. MOM-1 does not provide extraction and treatment of contaminated groundwater and therefore does not provide any reduction in the toxicity, mobility, or volume of contaminants other than through natural attenuation.

MOM-1 does not include any active remediation and therefore does not present a risk to the community or to workers at the site.

MOM-2 requires construction of pumping systems and treatment plants. Therefore, protection and controls will need to be provided to protect the community and on-site workers using measures such as dust control, personal protection equipment, and air monitoring during construction activities.

MOM-2 will comply with all State and Federal ARARs. Treatment plants will be located outside of wetlands and floodplains to the extent possible. The limited action alternative MOM-1 would not attain ARARs.

MOM-1 is easily implemented since it does not involve any construction. However, while it would be easy to implement, it does not use treatment to reduce the toxicity, mobility, or volume of contaminants at the source areas, is not protective of public health and the environment, and does not comply with ARARs. For MOM-2, treatment plants can be easily constructed at the individual source areas. All of the treatment technologies are well proven, reliable and available with the exception of UV/Chemical oxidation. UV/chemical oxidation is feasible and available, but is an innovative technology and may not be reliable for conditions at the Site. While carbon adsorption is feasible and available, it may not be reliable for the levels of VOC contamination found in groundwater at all of the source areas.

The preferred alternative MOM-2 is the least expensive alternative for addressing the remedial action objective of achieving cleanup goals in the bedrock and overburden aquifers (see further discussion of cost in Section XI.C.).

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Wells G & H Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs and is cost effective. The selected remedy also satisfies the statutory preference for treatment which permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element. Additionally, the selected remedy uses alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

A. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will significantly and permanently reduce the current and potential risks presently posed to human health and the environment by:

- reducing PCBs, PAHs, VOCs, and pesticides in the soil at the source areas of contamination to cleanup levels, thus preventing exposure to contamination that may present a risk to human health and wildlife;
- eliminating the leaching of soil contamination to the groundwater at levels in excess of groundwater cleanup goals;
- reducing the contamination in the bedrock and overburden aquifers in the vicinity of the source areas to cleanup levels;
- preventing off-site migration of contaminated groundwater from the source areas; and
- preventing further degradation of surface water in the Aberjona River by contaminated groundwater from the source areas.

B. The Selected Remedy Attains ARARs

This remedy will meet or attain all applicable or relevant and appropriate federal and state requirements that apply to the Site. Environmental requirements which are applicable or relevant and appropriate to the selected remedial action at the Wells G & H Site are:

Resource Conservation and Recovery Act (RCRA)

Toxic Substances Control Act (TSCA)

Clean Water Act (CWA)

Safe Drinking Water Act including the Underground Injection Control Provisions at 42 U.S.C. Section 300(H)

Executive Order 11988 (Floodplain Management)

Executive Order 11990 (Protection of Wetlands)

Clean Air Act (CAA)

Protection of Archeological Resources

Occupational Safety and Health Administration (OSHA)

Transportation of Hazardous Waste Regulations (DOT)

310 CMR 30.00 - Hazardous Waste Management Requirements

310 CMR 6.00 - Ambient Air Quality Standards for the Commonwealth of Massachusetts

310 CMR 7.00 - Air Pollution Controls

310 CMR 33.00 - Employee and Community Right to Know Requirements

310 CMR 10.00 - Massachusetts Wetlands Protection Requirements

314 CMR 3.00 - Surface Water Discharge Permit Program Requirements

314 CMR 4.00 - Surface Water Quality Standards

314 CMR 5.00 - Groundwater Discharge Permit Program

314 CMR 6.00 - Groundwater Quality Standards

310 CMR 9.00 - Massachusetts Water Ways Licenses

314 CMR 9.00 - Massachusetts Certification for Dredging and Filling

302 CMR 6.00 - Inland Wetlands Orders

314 CMR 12.00 - Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharges

Tables 8 and 9, taken from Section 1 of the Feasibility Study, list the chemical specific ARARs and guidances to be considered during the implementation of the remedy, present a brief synopsis of the requirements, and outline the action which will be taken to attain the ARARs. Tables 10 and 11, taken from Section 4 of the Feasibility Study, identify the action specific and location specific ARARs and guidances to be considered during the implementation of the source control and management of migration alternatives, present a brief synopsis of the requirements, and outline the action which will be taken to attain the ARARs.

C. The Selected Remedial Action is Cost Effective

Once EPA has identified alternatives that are protective of human health and the environment, and attain ARARs, EPA analyzes those alternatives to determine a cost-effective means of achieving the cleanup. Each of the alternatives underwent a detailed cost analysis to develop costs to the accuracy of -30 to +50 percent. In that analysis, capital and operation and maintenance costs have been estimated and then used to develop present worth costs. In the present worth analysis, annual costs were calculated for thirty years (estimated life of an alternative) using a five percent interest rate factor and were based on 1988 costs.

For source control, the combination of on-site incineration and in-situ volatilization is the least costly method for soil remediation except for the limited action alternative (Table 12). However, the limited action alternative will not meet ARARs, and is not protective of public health and the environment. Thus, the selected source control component is a cost effective method of achieving protection of human health and the environment.

For the management of migration alternative, the treatment of groundwater at one central treatment plant, by both the air stripping and UV/chemical oxidation treatment technologies, is less expensive than treatment at separate plants (see Table 4). EPA believes, however, that the public has raised valid concerns regarding the construction of a single central treatment facility. These concerns, discussed in Section VII and further documented in the Responsiveness Summary, include the fact that construction of a single central treatment facility would require that pipes be placed in a wetlands area, and that contaminated water be moved across uncontaminated areas of the Site. Therefore, EPA believes that construction of separate plants is the most cost effective option for groundwater treatment which does not potentially degrade the wetlands area or spread contamination across uncontaminated areas of the Site. Furthermore, treatment by air stripping at separate treatment plants is less costly than treatment by UV/chemical oxidation at separate treatment plants, and is therefore the most cost effective technology for achieving cleanup goals at the Site.

D. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

In-situ volatilization is an alternative treatment technology which provides permanent removal of the mass of volatile organic contamination in soil, thereby permanently and significantly reducing the toxicity, mobility and volume of contamination. Contaminant reduction efficiencies of 99.999% have been achieved at other sites using in-situ volatilization.

The incineration portion of the selected remedy also provides for permanent destruction of the PAHs, PCBs, VOCs, and pesticide components in the soil. Because incineration uses high temperatures to destroy virtually all of the organic contaminants in the soil, the treated soil can be used to fill in excavated areas on Site. Treated soil samples will be tested to confirm that the soil is acceptable as backfill.

The groundwater extraction/treatment portion of the selected remedy also provides permanent removal and reduction of the mass of volatile organic contaminants in groundwater through groundwater recovery and treatment via air stripping and carbon adsorption. Carbon columns will remove contaminants from the airstream before being released to the atmosphere. Treated groundwater will be discharged to the Aberjona River, reinjected to the aquifer, or both.

E. The Selected Remedy Satisfies the Preference for Treatment as a Principal Element

The principal elements of the selected source control remedy for contaminated soil are in-situ volatilization and incineration. The principal elements of the selected management of migration remedy for contaminated groundwater are air stripping and carbon adsorption. These elements are all technologies that use treatment to address all human health and environmental threats at the Site resulting from contamination of soil and groundwater.

XII. STATE ROLE

The Commonwealth of Massachusetts' Department of Environmental Protection has reviewed the various alternatives and has indicated its support for the selected remedy. The Commonwealth of Massachusetts has also reviewed the Remedial Investigations, Endangerment Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental laws and regulations. The Commonwealth of Massachusetts concurs with the selected remedy for the Wells G & H Site. A copy of the declaration of concurrence is attached as Appendix C.

WELLS G & H

Record of Decision Summary

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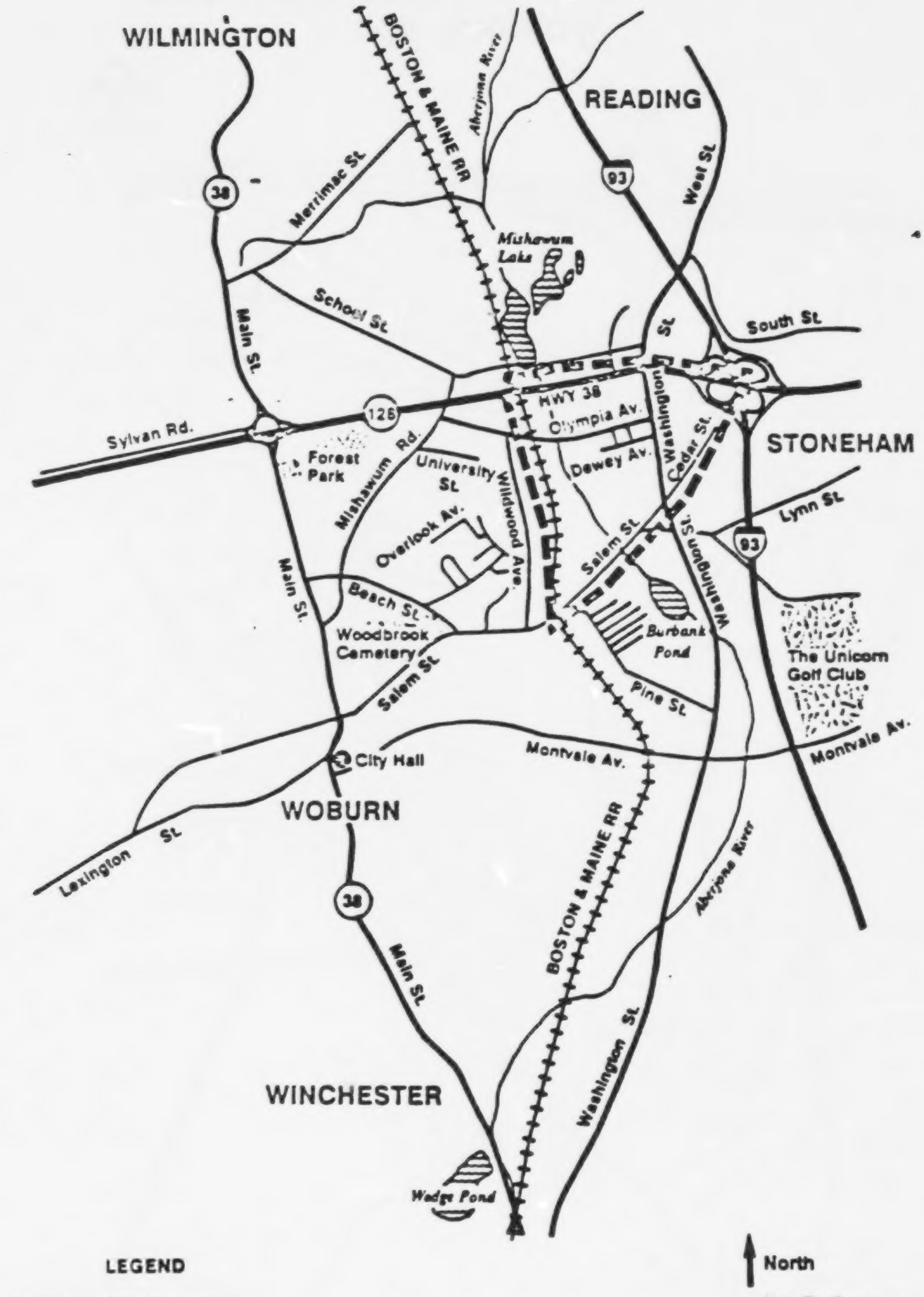
WELLS G & H

FIGURES

Figure | Site Location Map of Wells G and H in Woburn, MA



WILMINGTON
BOSTON & MAINE RR
Aberjona River
READING
93
West St.
38
Merrimac St.
Mishawum Lake
School St.
Main St.
South St.
St.
HWY 38
125
Olympia Av.
Sylvan Rd.
STONEHAM
Forest Park
University St.
Mishawum Rd.
Dewey Av.
Washington St.
Cedar St.
Wildwood Ave.
Overlook Av.
Lynn St.
Salem St.
Washington St.
93
Main St.
Beach St.
Woodbrook Cemetery
Burbank Pond
The Unicorn Golf Club
Salem St.
Pine St.
Montvale Av.
Montvale Av.
City Hall
WOBURN
Lexington St.
38
Aberjona River
Main St.
BOSTON & MAINE RR
Washington St.
WINCHESTER
Wedge Pond
LEGEND
Site Boundary
North
Not To Scale

FIGURE 2

SOURCE AREA MAP FOR THE WELLS G & H SITE
WOBURN, MA

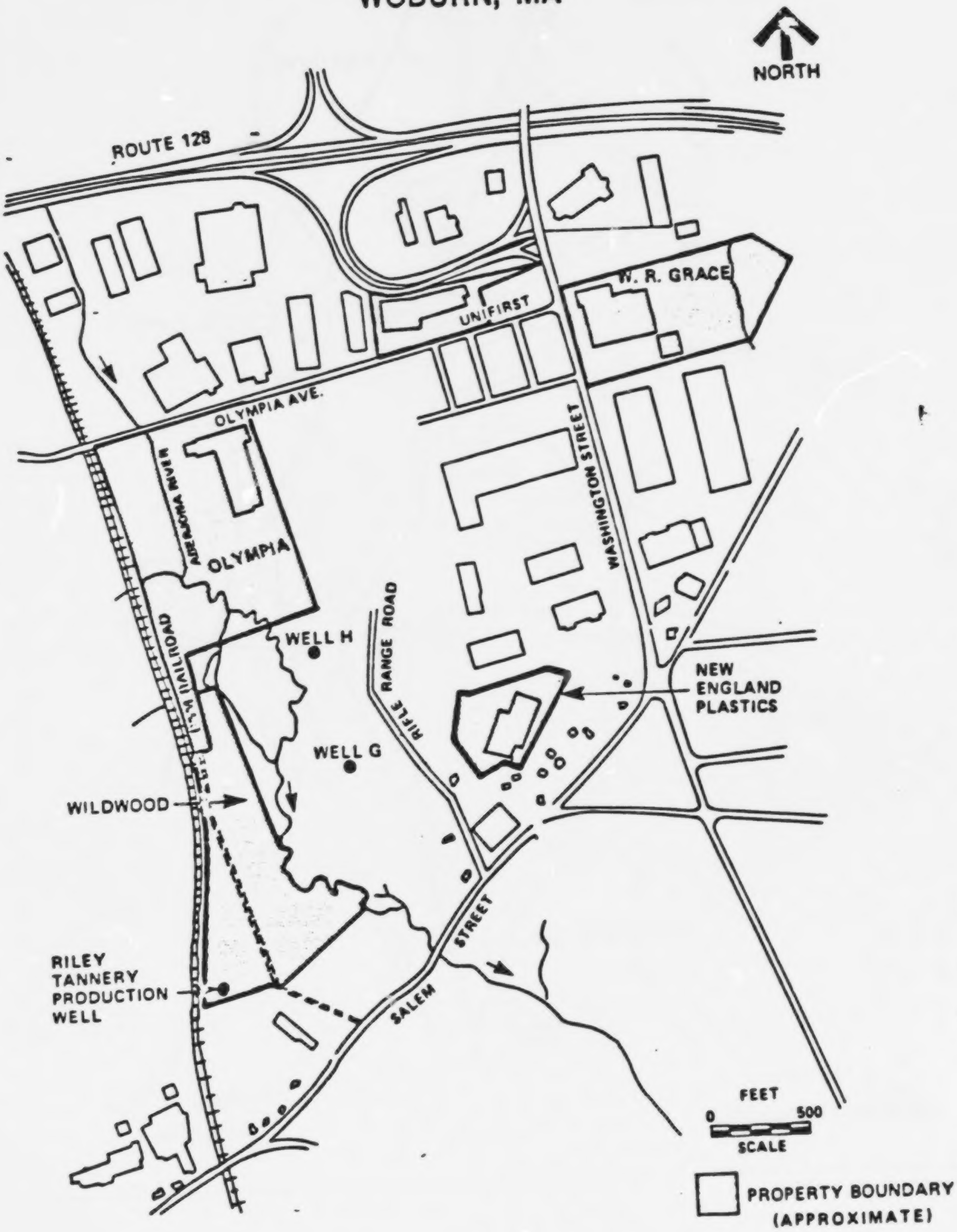
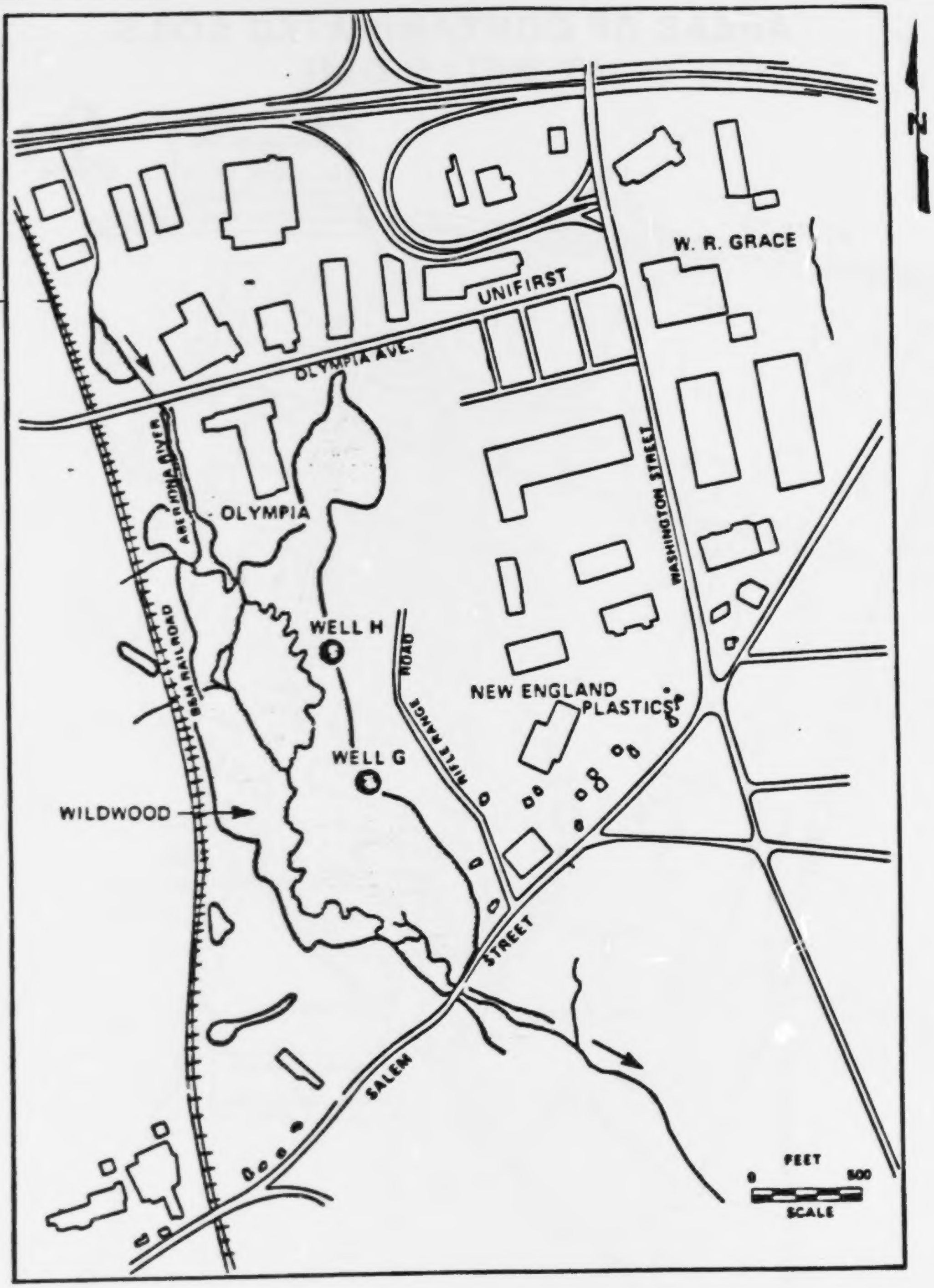

NORTH
ROUTE 128
W. R. GRACE
UNIFIRST
OLYMPIA AVE.
WASHINGTON STREET
ABERJONA RIVER
OLYMPIA
B & M RAILROAD
WELL H
RIFLE RANGE ROAD
NEW ENGLAND PLASTICS
WELL G
WILDWOOD
RILEY TANNERY PRODUCTION WELL
SALEM STREET
FEET
0
500
SCALE
PROPERTY BOUNDARY (APPROXIMATE)

FIGURE 3


N
W. R. GRACE
UNIFIRST
OLYMPIA AVE.
OLYMPIA
ABERJONA RIVER
B&M RAILROAD
WASHINGTON STREET
WELL H
WELL G
RIFLE RANGE ROAD
NEW ENGLAND PLASTICS
WILDWOOD
SALEM STREET
FEET
0
500
SCALE

☐ WETLANDS AREA

U.S. ENVIRONMENTAL
PROTECTION AGENCY

WELLS G & H

FIGURE 1–5
APPROXIMATE BOUNDARY OF THE
WETLANDS AREA

EBASCO SERVICES INCORPORATED

FIGURE 4
AREAS OF CONTAMINATED SOILS AT WELLS G&H

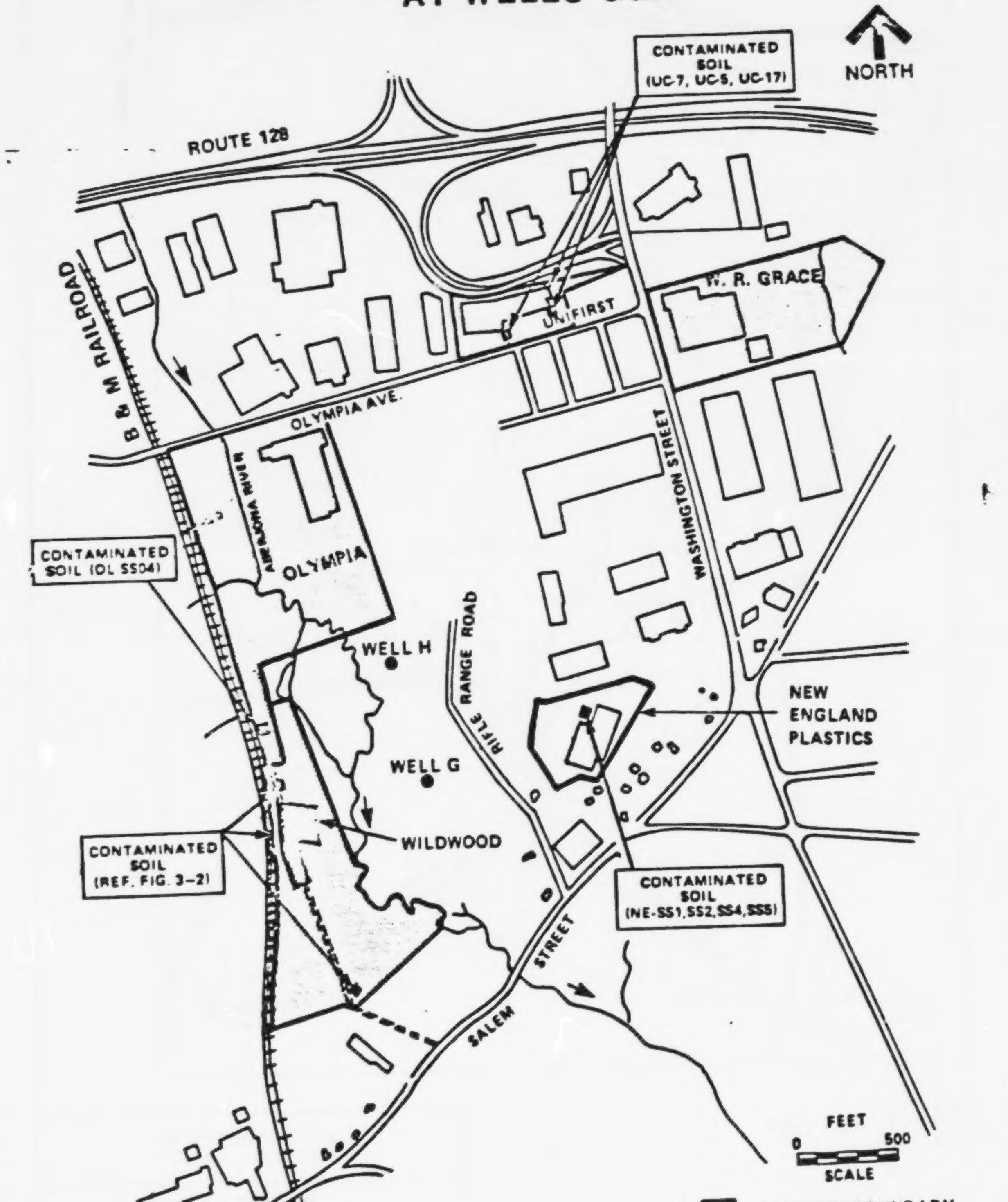
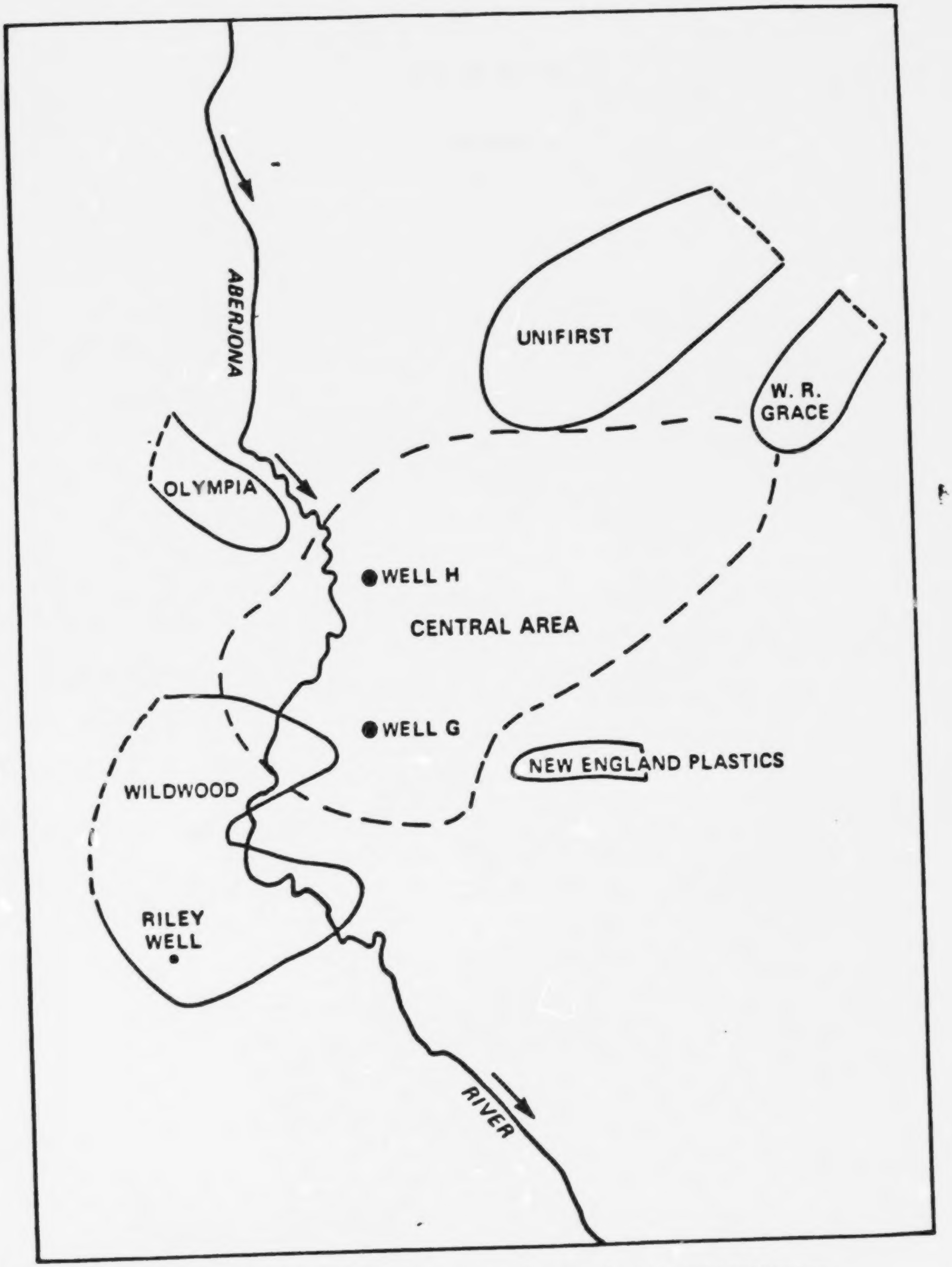

CONTAMINATED SOIL (UC-7, UC-5, UC-17)
NORTH
ROUTE 128
B & M RAILROAD
W. R. GRACE
UNIFIRST
OLYMPIA AVE.
WASHINGTON STREET
ABERJONA RIVER
OLYMPIA
CONTAMINATED SOIL (OL SS04)
WELL H
RIFLE RANGE ROAD
NEW ENGLAND PLASTICS
WELL G
WILDWOOD
CONTAMINATED SOIL (REF. FIG. 3-2)
CONTAMINATED SOIL (NE-SS1, SS2, SS4, SS5)
SALEM STREET
FEET
0
500
SCALE
PROPERTY BOUNDARY (APPROXIMATE)
LOCATIONS OF CONTAMINATED SOILS AT VARIOUS PROPERTIES

FIGURE 5*
LOCATION OF SOURCE PLUMES AND THE CENTRAL AREA AT THE WELLS G&H SITE


ABERJONA
UNIFIRST
W. R. GRACE
OLYMPIA
WELL H
CENTRAL AREA
WELL G
NEW ENGLAND PLASTICS
WILDWOOD
RILEY WELL
RIVER

* This figure represents the approximate area of groundwater contamination (Source: Feasibility Study, Appendix C, Figure C-1)

WELLS G & H

TABLES

Table 1
Chemicals of Potential Concern at the Wells G&H Site

	WR GRACE	NEW ENGLAND PLASTICS		OLYMPIA NOMINEE TRUST		UNIFIRST		WILDWOOD			CENTRAL AREA			
	GW	S	GW	S	GW	S	GW	S	SL	GW	S	SD	GW	SW
VOLATILE ORGANICS														
Acetone		●						●				●		
Chloroform									●	●				
1,2-Dichlorobenzene										●				
1,1-Dichloroethane					●		●							
1,2-Dichloroethane	●													
1,1-Dichloroethene	●						●							
trans-1,2-Dichloroethene	●		●		●		●	●	●	●			●	●
Methylene chloride		●						●				●		
Pentachlorophenol									●					
Phenol									●					
Tetrachloroethene	●	●	●		●	●	●	●	●	●			●	●
Toluene							●	●	●					
1,1,1-Trichloroethane		●	●				●		●	●			●	
Trichloroethene	●	●	●		●		●	●	●	●			●	●
Vinyl chloride	●									●				
Xylenes					●				●	●				
SEMI-VOLATILE ORGANICS														
Aldrin													●	
Bis(2-ethylhexyl)phthalate	●	●			●			●	●			●		●
Chlordane								●	●		●			
4,4'-DDT				●				●	●					
Polyaromatic hydrocarbons				●				●	●			●		
Polychlorinated biphenyls								●						
Pyrene											●			
INORGANICS														
Arsenic					●							●		
Barium													●	
Cadmium		●						●	●		●	●		
Chromium				●				●	●			●		
Copper												●		
Iron												●		
Lead		●		●				●	●		●	●		●
Manganese					●					●				
Mercury												●		
Nickel												●		
Zinc												●		
RADIONUCLIDES													●	

S -Soil
SL-Sludge
SD-Sediment
SW-Surface water
GW-Groundwater

DGW CHEM-C

TABLE 2

SUMMARY TABLE OF ESTIMATED RISKS ASSOCIATED WITH EXPOSURE AT THE WELLS G & H SITE

LOCATION	RISK		HAZARD INDEX	
	AVERAGE	PLAUSIBLE MAXIMUM	AVERAGE	PLAUSIBLE MAXIMUM
W. R. Grace and Company				
Ingestion of Groundwater	2E-03	2E-01	<1 (0.2)	>1 (24)
Inhalation of Volatiles Released while Showering	4E-04	5E-02	<1 (0.2)	>1 (23)
New England Plastics Corporation				
Inhalation of Volatiles Released During Industrial Processes by Industrial Workers	1E-07	1E-06	<1 (0.007)	<1 (0.06)
Dermal Contact and Incidental Ingestion of Surface Soil by Industrial Workers	7E-08	4E-05	<1 (0.005)	<1 (0.7)
Inhalation of Volatiles Released from Soil by Industrial Workers	3E-13	1E-09	<1 (8E-09)	<1 (4E-05)
Future Exposure to Surface Soil	1E-08	8E-04	<1 (0.02)	>1 (4)
Future Inhalation of Volatiles Released from Soil	3E-12	1E-08	<1 (1E-08)	<1 (2E-04)
Future Ingestion of Groundwater	8E-05	5E-04	<1 (0.08)	<1 (0.5)
Future Inhalation of Volatiles Released While Showering	6E-06	3E-05	<1 (0.07)	<1 (0.4)
Olympia Nominee Trust Company				
Dermal Contact and Incidental Ingestion of Soil by Industrial Workers	5E-10	3E-06	<1 (0.002)	<1 (0.3)
Dermal Contact and Incidental Ingestion of Soil by Young Adults	2E-09	3E-06	<1 (0.01)	<1 (0.9)
Inhalation of Dust Generated While Dirtbike Riding	3E-08	5E-06	<1 (2E-05)	<1 (0.001)
Future Exposure to Surface Soil	2E-08	6E-05	<1 (0.009)	<1 (0.8)
Future Ingestion of Groundwater	4E-04	1E-03	<1 (0.2)	<1 (0.7)
Future Inhalation of Volatiles Released While Showering	9E-06	4E-04	<1 (0.02)	<1 (0.06)
Unifirst Corporation				
Future Ingestion of Groundwater	1E-03	4E-02	1	>1 (47)
Future Inhalation of Volatiles Released While Showering	3E-04	1E-02	<1 (0.9)	>1 (41)
Future Exposure to Surface Soil	8E-10	4E-08	<1 (8E-07)	<1 (4E-05)
Wildwood Conservation Corporation				
Dermal Contact and Incidental Ingestion of Soil				
- Surface Soil	7E-08	7E-05	<1 (0.02)	>1 (2)
- Northern Sludges	8E-07	5E-05	<1 (0.4)	>1 (12)
- Southern Sludges	2E-07	2E-05	<1 (0.3)	>1 (18)
Inhalation of Dust Generated While Dirtbike Riding				
- Surface Soil	1E-07	3E-05	<1 (0.002)	1
- Northern Sludges	5E-07	3E-05	<1 (0.004)	<1 (0.5)
- Southern Sludges	7E-08	3E-06	<1 (0.0005)	<1 (0.3)

NOTE: Scientific notation (such as 2E-06) is a shorthand way of indicating decimal places, (i.e., the magnitude of the number). A negative exponent indicates that the decimal should be moved the specified number of places to the left (i.e., 2E-03 = 0.002 = 2×10^{-3})

TABLE 2 CONTINUED

SUMMARY TABLE OF ESTIMATED RISKS ASSOCIATED WITH
EXPOSURE AT THE WELLS G & H SITE

LOCATION	RISK		HAZARD INDEX	
	AVERAGE	PLAUSIBLE MAXIMUM	AVERAGE	PLAUSIBLE MAXIMUM
Wildwood Conservation Corporation Continued				
Future Exposure to Surface Soil				
- Surface Soil	7E-07	2E-03	<1 (0.01)	>1 (3)
- Northern Sludges	8E-06	1E-03	<1 (0.3)	>1 (14)
- Southern Sludges	2E-06	4E-04	<1 (0.2)	>1 (20)
Future Inhalation of Volatiles Released from Soil				
- Surface Soil	3E-07	1E-04	<1 (0.0009)	<1 (0.8)
- Northern Sludges	1E-07	2E-04	<1 (0.002)	<1 (0.3)
- Southern Sludges	1E-09	1E-05	<1 (2E-06)	<1 (0.2)
Future Ingestion of Groundwater	8E-04	2E-01	<1 (0.2)	>1 (116)
Future Inhalation of Volatiles Released While Showering	2E-04	7E-02	<1 (0.08)	>1 (96)
Nonsource Area of Wells G&H				
Inhalation of Volatiles Released During Industrial Processes by Industrial Workers	2E-06	3E-05	<1 (0.1)	<1 (0.3)
Dermal Contact and Incidental Ingestion of Soil	2E-09	1E-07	<1 (0.03)	<1 (0.2)
Incidental Ingestion of Surface Water				
- Adults	4E-11	1E-08	<1 (2E-05)	<1 (8E-04)
- Children	2E-09	6E-08	<1 (0.001)	<1 (0.02)
Dermal Contact and Incidental Ingestion of Sediments				
- Adults	3E-07	4E-04	<1 (0.002)	<1 (0.09)
- Children	8E-07	2E-04	<1 (0.003)	<1 (0.02)
Future Ingestion of Groundwater	4E-05	3E-04	<1 (0.1)	1
Future Ingestion of Groundwater Containing Radionuclides				
- Gross Alpha Particles	--	--	>1 (3)	>1 (35)
- Gross Beta Particles	--	--	<1 (0.6)	>1 (4)
- Strontium-90	--	--	<1 (3E-04)	<1 (0.002)
- Tritium	--	--	<1 (0.2)	1
- Radium	--	--	<1 (0.03)	<1 (0.05)
- Uranium				
Future Inhalation of Volatiles Released While Showering	4E-06	3E-05	<1 (0.05)	<1 (0.6)

NOTE. Scientific notation (such as 2E-06) is a shorthand way of indicating decimal places. (i.e., the magnitude of the number). A negative exponent indicates that the decimal should be moved the specified number of places to the left (i.e., 2E-03 = 0.002 = 2x10-3)

TABLE 3

LIST OF ALTERNATIVES FOR DETAILED ANALYSIS

Source Control Alternatives (SC)

SC-1	No Action (Source Control)
SC-3	Excavation7On-Site Incineration/Backfill On-Site
SC-4	Excavation/Off-Site Incineration/Backfill with Clean Off-Site Soil
SC-5	Excavation/On-Site High Temperature Enhanced Volatilization/Backfill On-Site
SC-7	Excavation/On-Site Supercritical Fluid Extraction/ Backfill On-Site
SC-8	Excavation/On-Site Enhanced Volatilization/On-Site Incineration/Backfill On-Site
SC-9	Excavation/On-Site Enhanced Volatilization/Off-Site Incineration/Backfill With Treated and Clean Off-Site Soil
SC-10	In Situ Volatilization/Excavation/On-Site Incineration/ Backfill On-Site
SC-11	In Situ Volatilization/Excavation/Off-Site Incineration/ Backfill With Clean Off-Site Soil

Management of Migration Alternatives (MOM)

MOM-1	No Action (Management of Migration)
MOM-2	Pump and Treat Source Areas
-2A(i)	Pretreatment and Air Stripping at Separate Treatment Plants
-2A(ii)	Pretreatment and Air Stripping at a Central Treatment Plant
-2B(i)	Pretreatment and UV/Chemical oxidation at Separate Treatment Plants
-2B(ii)	Pretreatment and UV/Chemical oxidation at a Central Treatment Plant
MOM-3	Pump and Treat Central Area
-3A	Pretreatment and Air Stripping at Central Treatment Plant

TABLE 3 (Cont'd)

LIST OF ALTERNATIVES FOR DETAILED ANALYSIS

-3B	Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant
-3C	Pretreatment and Carbon Adsorption at a Central Treatment Plant
MOM-4	Pump and Treat Source Areas and Central Area
-4A(i)	Pretreatment and Air Stripping at Separate Treatment Plants
-4A(ii)	Pretreatment and Air Stripping at a Central Treatment Plant
-4B(i)	Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
-4B(ii)	Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

Table 4 Costs Associated with Groundwater Treatment Alternatives

(Total Present Worth Cost)

	Alternative No. 1 No Action[1]	Alternative No. 2 Pump and Treat Source Areas	Alternative No. 3 Pump and Treat Central Area	Alternative No. 4 Pump and Treat Source Areas and Central Area
Air Stripping				
Treatment at Separate Plants	N/A	$65,200,000[2]	N/A	$79,100,000
Treatment at One Central Plant	N/A	$27,400,000	$24,200,000	$37,100,000
Ultraviolet (UV)/Chemical Oxidation				
Treatment at Separate Plants	N/A	$89,100,000	N/A	$104,800,000
Treatment at One Central Plant	N/A	$44,200,000	$28,200,000	$60,200,000
Carbon Adsorption				
Treatment at Separate Plants	N/A	N/A	N/A	N/A
Treatment at One Central Plant	N/A	N/A	$26,900,000	N/A

1. Total present worth cost of no-action: $440,000.
2. This is the preferred alternative for groundwater treatment.

Other Notes

Alternatives 2,3 & 4 have been costed to 30 years only; however, some alternatives may take longer than 30 years to complete cleanup.

Alternative No. 1 predicted to exceed 100 years to remediate.

Alternative No. 2 predicted to take 22 years for central area; 20-50 years for source areas to remediate.

Alternative No. 3 predicted to exceed 60 years to remediate.

Alternative No. 4 predicted to take 10 years for central area, 20-50 years for source areas to remediate.

[See Appendix C in FS for detailed discussion of timeframes.]

Table 5

ACTION LEVELS FOR SOIL AT THE WELLS G & H SITE BASED ON THE LEACHING OF CONTAMINANTS FROM SOIL INTO GROUNDWATER

A. POTENTIAL CARCINOGENS

COMPOUND	Koc (1/kg)	Kd (1/kg)	DRINKING WATER STANDARD (mg/1)	TARGET SOIL CCONCENTRATION (ug/kg)
Chloroform	3.10E+01	3.10E-01	1.00E-01 MCL (a)	62.5
Tetrachloroethene	3.64E+02	3.64E+00	5.00E-03 MCL (b)	36.7
Trichloroethene	1.26E+02	1.26E+00	5.00E-03 MCL	12.7

B. NONCARCINOGENS

COMPOUND	Koc (1/kg)	Kd (1/kg)	DRINKING WATER STANDARD (mg/1)	TARGET SOIL CONCENTRATION (ug/kg)
trans-1.2-Dichloroethene	5.90E+01	5.90E-01	7.00E-02 MCLG (c)	83.2
1.1.1-Trichloroethane	1.52E+02	1.52E+00	2.00E-01 MCL	613

Action levels based on the attainment of a target risk level in soils which corresponds to the attainment of ARARs in groundwater.

(a) MCL is for total trihalomethanes. refers to the sum of chloroform, bromochloromethane, and bromoform.

(b) MCL is for trichloroethene. This value was used based on the chemical similarities between the two compounds and their toxicological endpoints.

(c) Proposed.

NOTE. Scientific notation (such as 2E-06) is a shorthand way of indicating decimal places. (i.e., the magnitude of the number). A negative exponent indicates that the decimal should be moved the specified number of places to the left (i.e., 2.4E-03 = 0.0024 = $2.4\text{x}10^{-3}$)

(Source: Feasibility Study, Section 1.0, Table 1-5)

Table 6

ACTION LEVELS FOR SOIL AT THE WELLS G & H SITE
FUTURE USE CONDITIONS FOR DIRECT CONTACT

POTENTIAL CARCINOGENS

COMPOUND	POTENCY FACTOR (mg/kg/d)-1	TARGET SOIL CONCENTRATION (mg/kg)			
		TARGET RISK LEVEL			
		10-4	10-5	10-6 *	10-7
Chlordane	1.30E+00	6.14E+02	6.14E+01	6.14E+00	6.14E-01
4,4'-DDT	3.40E-01	2.35E+03	2.35E+02	2.35E+01	2.35E+00
cPAHs	1.15E+01	6.94E+01	6.94E+00	6.94E-01	6.94E-02
PCBs	7.70E+00	1.04E+02	1.04E+01	1.04E+00	1.04E-01

Action levels based on the attainment of a target risk level for the potential carcinogens and a CDI:RfD of one for the noncarcinogens for exposure to compounds in the soil via direct contact (dermal contact with and and incidental ingestion of soil); exposure assumptions are presented in the endangerment assessment and below.

GENERAL ASSUMPTIONS: Body weight = 70 kg; Average lifetime = 70 yrs; Exposure period = 70 yrs; Frequency of exposure = 100 d/yr; Incidental ingestion rate = 54 mg/d; Dermal contact rate = 790 mg/d.

ASSUMPTIONS FOR PESTICIDES, PAHS, AND PCBS: Ingestion absorption factor = 0.3; Dermal absorption factor = 0.02.

ASSUMPTIONS FOR VOLATILE ORGANICS: Ingestion absorption factor = 1.0; Dermal absorption factor = 0.3.

ASSUMPTIONS FOR INORGANICS: Ingestion absorption factor = 1.0; Dermal absorption is negligible.

NOTE: Scientific notation (such as 2E-06) is a shorthand way of indicating decimal places, (i.e., the magnitude of the number). A negative exponent indicates that the decimal should be moved the specified number of places to the left (i.e., 2.4E-03 = 0.0024 = 2.4×10^{-3})

* Cleanup levels for the Wells G & H Site are based on a 10^{-6} risk level.

(Source: Feasibility Study, Section 1.0, Table 1-6)

Table 7

ARAR-BASED ACTION LEVELS FOR GROUNDWATER

A. POTENTIAL CARCINOGENS

COMPOUND	DRINKING WATER STANDARD OR CRITERIA (ug/1)	INTAKE (mg/kg/day)	POTENCY FACTOR (mg/kg/day)-1	RISK
Chloroform	100 MCL (a)	2.86E-03	6.10E-03	1.7E-05
1,1-Dichloroethane	5 (b)	1.43E-04	9.10E-02	1.3E-05
1,2-Dichloroethane	5 MCL	1.43E-04	9.10E-02	1.3E-05
1,1-Dichloroethene	7 MCL	2.00E-04	5.80E-01	1.2E-04
Tetrachloroethene	5 (c)	1.43E-04	5.10E-02	7.3E-06
Trichloroethene	5 MCL	1.43E-04	1.10E-02	1.6E-06
Vinyl Chloride	2 MCL	5.71E-05	2.30E+00	1.3E-04

B. NONCARCINOGENS

COMPOUND	DRINKING WATER STANDARD OR CRITERIA (mg/1)	INTAKE (mg/kg/day)	REFERENCE DOSE (RfD) (mg/kg/day)	RATIO OF INTAKE TO RfD
trans-1,2-Dichloroethene	70 MCLG (d)	2.00E-03	1.00E-02	2.00E-01
1,1,1-Trichloroethane	200 MCL	5.71E-03	9.00E-02	6.35E-02

(a) MCL is for total trihalomethanes, refers to the sum of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

(b) MCL is for 1,2-Dichloroethane. This value was used based on the chemical similarities between the two compounds and their toxicological endpoints.

(c) MCL is for trichloroethene. This value was used based on the chemical similarities between the two compounds and their toxicological endpoints. This value is also the CLP detection limit.

(d) Proposed.

NOTE: Scientific notation (such as 2E-06) is a shorthand way of indicating decimal places, (i.e., the magnitude of the number). A negative exponent indicates that the decimal should be moved the specified number of places to the left (i.e., 2.4E-03 = 0.0024 = 2.4×10^{-3})

(Source: Feasibility Study, Section 1.0, Table 1-4)

TABLE 8

CHEMICAL - SPECIFIC ARARS AND TBCS FOR WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
1) ARARS		
o DWA - Maximum Contaminant Levels (MCLs) (40 CFR 141.11 -141.16)$_2$	o MCLS have been promulgated for a number of common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers potentially used for drinking water.	o Treatment will be conducted to achieve SDWA MCLs in groundwater.
o RCRA - Maximum Concentraton Limits (MCLS) (40 CFR 264.94)$_2$	o RCRA MCLS provide groundwater protection standards for 14 common contaminants. All are equal to the SDWA MCLs for those contaminants.	o Treatment will be conducted to achieve RCRA MCLs in groundwater.
o DEQE Regulations - Massachusetts Drinking Water Maximum Contaminant Levels (MCL) (310 CMR 22.00)$_2$	o Massachusetts MCLs establish levels of contaminants allowable in public water supplies. They are essentially equivalent to SDWA MCLs.	o Since DEQE MCLS are the same as SDWA MCLs, they were used to set clean-up levels for contaminants of concern.
o DEQE - Massachusetts Groundwater Quality Standards (314 CMR 6.00)$_2$	o These standards consist of groundwater classifications which designate and assign the uses of Commonwealth groundwaters, and water quality criteria necessary to substain these uses. There is a presumption that all groundwaters are Class I.	o DEQE groundwater standards were considered when determining clean-up levels.
o CWA - Ambient Water Quality Criteria (AWQC) - Protection of Freshwater Aquatic Life, Human Health - Fish Consumption	o AWQC are developed under the Clean Water Act (CWA) as guidelines from which states develop water quality standards. A more strigent AWQC for aquatic life may be found relevant and appropriate rather than an MCL, when protection of aquatic organisms is being considered at a site.	o AWQC were used to characterize risks to fresh water aquatic life resulting from discharge of treated groundwater to the Aberjona River.
2) TBCS		
o EPA Risk Reference Doses (RfDs)	o RfDs are dose levels developed by the EPA for noncarcinogenic effects.	o EPA RfDs were used to characterize risks due to exposure to contaminants in groundwater, as well as other media.
o EPA Carcinogen Assessment Group Potency Factors	o Potency Factors are developed by the EPA from Health Assessments or evaluation by the Carcinogen Efforts Assessment Group.	o EPA Carcinogenic Potency Factors were used to compute the individual incremental cancer risk resulting from exposure to site contamination.
o Massachusetts Drinking Water Halth Adviseries	o DEQE Health Advisories are guidance criteria for drinking water.	o DEQE Health Advisories were considered when developing clean-up levels for groundwater.

TABLE 9

CHEMICAL-SPECIFIC POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND "TO BE CONSIDERED" REQUIREMENTS

	Safe Drinking Water Act Maximum Contaminant Levels (MCLs) 40 CFR 141	Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) 40 CFR 141 & 50 FR 46936	Clean Water Act Water Quality Criteria for Fresh-Water Aquatic Life Acute/Chronic	Clean Water Act Water Quality Criteria for Human Health - Fish Consumption	Massachusetts Drinking Water Maximum Contaminant Levels (e) (310 CMR 22.00)
1,1-Dichloroethene	7	7	11,600/-(c)	1.85	7
1,1,1-Trichloroethane	200	200	-	1,030,000	200
trans-1,2-Dichloroethene	-	70**	-	-	-
Tetrachloroethene	-	0**	5,280/840(c)	8.85	-
Trichloroethene	5	0	45,000/21,900(c)	80.7	5
Chloroform	100(a)	-	28,900/1,240(c)	15.7	100(a)
Trichlorofluoroethane	-	-	-	-	-
Methylene chloride	-	-	-	-	-
Carbon tetrachloride	5	0	35,200/-(c)	6.94	5
para-Dichlorobenzene	75	-	1,100/760(c)	2,600	75
Dichlorobenzenes	-	-	1,100/760(c)	2,600	-
1,1-Dichloroethane	-	-	-	-	-
1,2-Dichloroethane	5	0	118,000/20,000(c)	243	5
1,2,4-Trichlorobenzene	-	-	-	-	-
Vinyl Chloride	2	0	-	525	2
1,2-Dichlorobenzene	-	-	1,120/763(c)	2,600	-
Benzene	5	0*	5,300/-(c)	40	5
Toluene	-	2000**	17,500/-(c)	424,000	-
Acetone	-	-	-	-	-
Methyl ethyl ketone (MEK)	-	-	-	-	-
Ethylbenzene	-	680**	32,000/-(c)	3,250	-
Xylene	-	440**	-	-	-
Styrene	-	140**	-	-	-

All values in ug/l unless otherwise noted

TABLE 9 (Cont'd)

CHEMICAL-SPECIFIC POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND "TO BE CONSIDERED" REQUIREMENTS

	Safe Drinking Water Act Maximum Contaminant Levels (MCLs) 40 CFR 141	Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) 40 CFR 141 & 50 FR 46936	Clean Water Act Water Quality Criteria for Fresh-Water Aquatic Life Acute/Chronic	Clean Water Act Water Quality Criteria for Human Health - Fish Consumption	Massachusetts Drinking Water Maximum Contaminant Levels (e) (310 CMR 22.00)
Carbon Disulfide	-	-	-	-	-
Phenol	-	-	10,200/2,560(c)	-	-
Naphthalene	-	-	2,300/620	-	-
2-Methylnaphthalene	-	-	-	-	-
dibutyl phthalate	-	-	-	154,000	-
diethyl phthalate	-	-	-	1,800,000	-
bis(2-ethylhexyl)phthalate	-	-	-	50,000(h)	-
Acenaphthylene	-	-	-	-	-
Acenaphthene	-	-	1,700/520(c)	-	-
Phenanthrene	-	-	-	-	-
Fluoranthene	-	-	3,980/-(c)	54	-
Chrysene	-	-	-	-	-
2-Methylphenol	-	-	-	-	-
4-Methylphenol	-	-	-	-	-
2,4-Dimethylphenol	-	-	2,120/-(c)	-	-
2-Hexane	-	-	-	-	-
4-Ethyl-2-pentanone	-	-	-	-	-
Trichloroisocyanuric acid	-	-	-	-	-
Chlordane	-	0**	2.4/0.0043	.00048	-
Polychlorinated Biphenyls	-	0**	2.0/0.014	0.000079	-
Arsenic	50	50**	850/48(c)(f)	.0175	50
Chromium	50(b)	120**	1,700/210(d)(g)	3,433,000(g)	50

All values in ug/l unless otherwise noted

TABLE 9 (Cont'd)

CHEMICAL-SPECIFIC POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND "TO BE CONSIDERED" REQUIREMENTS

	Safe Drinking Water Act Maximum Contaminant Levels (MCLs) 40 CFR 141	Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) 40 CFR 141 & 50 FR 46936	Clean Water Act Water Quality Criteria for Fresh-Water Aquatic Life Acute/Chronic	Clean Water Act Water Quality Criteria for Human Health - Fish Consumption	Massachusetts Drinking Water Maximum Contaminant Levels (e) (310 CMR 22.00)
Barium	1000	1500**	-	-	1,000
Mercury	2	3**	2.4/0.012	0.146	2
Lead	50(5*)	20**(0*)	82/3.2$^{(d)}$	-	50
Cadmium	10	5**	3.9/1.1$^{(d)}$	-	10
Manganese	-	-	-	100	-
Zinc	-	-	120/110$^{(d)}$	-	-
Iron	-	-	1,000	-	-
Cadmium	10	-	3.9/1.1$^{(c)}$	-	10
Copper	1,300*	1,300*	18/12 $^{(d)}$	-	-
Nickel	-	-	1,400/160 $^{(d)}$	100	-

All values in ug/l unless otherwise noted.

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* - Proposed MCL or MCLG (1988) (53 FR 31516)

** - Proposed MCLGs 50 FR 46936 (November 13, 1985)

(a) MCL for total trihalomethane concentration

(b) Chromium +6

(c) Lowest Observed Effect Level

(d) Hardness dependent criteria (100 mg/l used)

(e) As of 8/31/1988

(f) Value shown is for (pent)arsenic. (tri)arsenic is 360/190 ug/L.

(g) (tri)chromium

(h) Value shown is for di-2-ethylhexylphthalate.

TABLE 10

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR ALTERNATIVE SC-10: IN-SITU VOLATILIZATION/EXCAVATION/ON-SITE INCINERATION/BACKFILL ON-SITE WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
1) Action-Specific ARARs		
o RCRA - General Facility Requirements (40 CFR 264.10-264.18)^2	o General facility requirements outline general waste security measures, inspections, and training requirements.	o Facilities will be constructed, fenced, posted, and operated in accordance with this requirement. All workers will be properly trained.
o RCRA Incineration Requirements (40 CFR 264 Subpart O)^2	o Principal Organic Hazardous Constituents (POHC) are to be destroyed to 99.99 percent destruction and removal efficiency, stringent particulate and HCL limits are imposed.	o On-site incineration activities will be designed and operated in compliance with Subpart O.
o TSCA - PCB Incineration Requirements (40 CFR 761.70(a)(2),(b)^1	o Contaminated soil in excess of 50 ppm PCB concentration must be incinerated to a 99.9999 percent destruction efficiency.	o Appropriate technology will be employed to achieve the 99.9999 percent TSCA destruction requirement.
o RCRA - Generator and Transporter Responsibilities (40 CFR 262 and 263)^2	o Provides standards for packing and accumulating hazardous waste prior to off-site disposal.	o Decontamination and scrubber water and carbon adsorption waste management and off-site disposal will proceed in accordance with RCRA requirements.
o RCRA - Land Disposal Restrictions (40 CFR 268)^2	o Provide treatment standards and schedules governing land disposal of RCRA wastes and of materials contaminated with or derived from RCRA wastes.	o On-site incinerators will be designed in accordance with standards to allow site-specific RCRA delisting of material.
o RCRA - Container Requirements (40 CFR 264 Subpart I)^2	o This regulation sets forth RCRA requirements for use and management of containers at RCRA facilities.	o Packing and accumulation of excavated soil treatment sludges and other materials will adhere to these standards.
o DOT - Transportation of Hazardous Waste Requirements (49 CFR 171-179)^2	o Those regulations set forth DOT requirements for transportation of hazardous waste. These are generally identical to RCRA requirements at 40 CFR 263.	o All on- and off-site transport of excavated soil treatment sludges, and other materials will follow these standards.

TABLE 10 (Cont'd)

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR ALTERNATIVE SC-10: IN-SITU VOLATILIZATION/EXCAVATION/ON-SITE INCINERATION/BACKFILL ON-SITE
WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o RCRA - Tank Requirements (40 CFR 264 Subpart J)	o Provides design and operating requirements for RCRA waste treatment facilities utilizing tanks.	o Design and operation of the in-situ volatilization facility will follow these requirements.
o RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.31)[2]	o This regulation outlines requirements for safety equipment and spill control.	o On-site facilities and activities will be designed and operated in accordance with RCRA requirements.
o RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56)[2]	o This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	o Emergency procedures will be developed and implemented in accordance with RCRA requirements.
o RCRA - Manifesting, Recordkeeping, and Reporting (40 CFR 264.70 - 264.77)[2]	o This regulation specifies the recordkeeping and reporting requirements for RCRA facilities.	o Records will be maintained during site remediation in compliance with this requirement.
o RCRA - Closure and Post-Closure (40 CFR 264 Subpart G)[2]	o This regulation details the specific requirements for closure and post-closure care of hazardous waste facilities.	o Hazardous waste facilities will be closed in a manner that meets the requirements of the closure regulations.
o OSHA - General Industry Standards (29 CFR 1910)[1]	o This regulation specifies the 8-hour, time-weighted average concentration for various organic compounds and 2 PCB compounds; site control procedures; training; and protective clothing requirements for worker protection at site remediations.	o Proper respiratory equipment will be worn if it is not possible to maintain the work atmosphere below these concentrations.
o OSHA - Safety and Health Standards (29 CFR 1926)[1]	o This regulation specifies the type of safety equipment and procedures to be followed during construction and excavation activities.	o All appropriate safety equipment will be on-site and procedures will be followed during groundwater monitoring and excavation.
o OSHA - Recordkeeping, Reporting and Related Regulations (29 CFR 1904)[1]	o The regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	o These regulations are applicable to the company contracted to execute site remediation.

TABLE 10 (Cont'd)

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR ALTERNATIVE SC-10: IN-SITU VOLATILIZATION/EXCAVATION/ON-SITE INCINERATION/BACKFILL ON-SITE
WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o DEQE - Hazardous Waste Management Requirements (310 CMR 30.00)[2]	o These regulations provide comprehensive monitoring, storing, recordkeeping, etc. programs at hazardous waste sites.	o During remedial design, these regulations will be compared to the corresponding federal RCRA regulations, and the more stringent requirements will be utilized. Note that Massachusetts considers soil contaminated in excess of 50 ppm PCBs to be a hazardous waste (310 CMR 30.131, waste #M002).
o DEQE - Hazardous Waste Incinerator Air Emisson Requirements 310 CMR 7.08(4)[2]	o Provides air emission requirements for hazardous waste incinerators. Principal Organic Hazardous Constituents (POHCS) destroyed to 99.99 percent, PCBs to 99.9999 percent. Particulate, HCL and CO emissions also controlled.	o On-site incineration activities to be designed and operated in compliance with requirements.
o TSCA - Marking of PCBs and PCB Items (40 CFR 761.40 - 761.79)[1]	o 50 ppm PCB storage areas, storage items, and transport equipment must be marked with the M_L mark.	o All storage areas, drums, and transport equipment will carry the appropriate markings displayed in an easily readable position.
o TSCA - Storage and Disposal (40 CFR 761.60 - 761.79)[1]	o This requirement specifies the requirements for storage and disposal/destruction of PCBs in excess of 50 ppm. These PCB-contaminated soils would have to be disposed of or treated in a facility permitted for PCBs, in compliance with TSCA regulations. Treatment must be performed using incineration or some other method with equivalent destruction efficiencies.	o Storage areas for drums containing PCB soils in excess of 50 ppm will be constructed to comply with this requirement. Verification of incinerator compliance will be made prior to drum shipment.
o TSCA - Records and Reports (40 CFR 761.18-761.185)[1]	o This regulation outlines the requirements for recordkeeping for storage and disposal of >50 ppm PCBs.	o Records will be maintained during remedial action in compliance with this regulation for all PCB drums which contain soils in excess of 50 ppm.
o CAA - National Air Quality Standards for Total Suspended Particulates (40 CFR 129.105, 750)[1]	o This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter.	o Fugitive dust emissions from site activities will be maintained below 150 ug/m^3 (secondary standard) by water sprays and other dust suppressants.
o DEQE - Ambient Air Quality Standards for the Commonwealth of Massachusetts[1] (310 CMR 6.00)	o This regulation specifies dust, odor, and noise emissions from construction activities.	o Fugitive dust will be controlled by water sprays or suppressants. All equipment will be maintained so as not to produce excessive noise.
o DEQE - Air Pollution Controls (310 CMR 7.00) 1	o Regulates new sources of air pollution to prevent air quality degradation. Requires the use of "Best Available Control Technology" (BACT) on all new sources.	o BACT will be used on all new sources.

TABLE 10 (Cont'd)

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR ALTERNATIVE SC-10:
IN-SITU VOLATILIZATION/EXCAVATION/ON-SITE INCINERATION/BACKFILL ON-SITE
WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o Employee and Community Right-to-Know Requirements (310 CMR 33)(1)	o Establishes rules for the dissemination of information related to toxic and hazardous substances to the public.	o Information dissemination procedures in these regulations will be used.
2) Action-Specific TBCs		
o RCRA - Proposed Air Emission Standards for Treatment Facilities (52 FR 3748, February 5, 1987)	o This proposal would set performance standards for RCRA treatment facility air emissions.	o Volatilization facilities and other non-incinerators that have air emissions (e.g., air strippers) will be designed to meet the proposed federal regulations.
3) Location-Specific ARARs		
o RCRA - Location Standards (40 CFR 264.18)[1]	o This regulation outlines the requirements for constructing a RCRA facility on a 100-year floodplain. A facility located on a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless waste may be removed safely before floodwater can reach the facility, or no adverse effects on human health and the environment would result if washout occurred.	o It is assumed that remediation facilities will be located outside floodplains. Temporary staging areas or remediation facilities that are located in a floodplain will be a designed to allow quick mobilization out of the area and to prevent damage caused by initial floodwaters.
o CWA - Section 404 Dredge and Fill Requirements (Guidelines at 40 CFR 230)[1]	o The placement for fill following excavation of contaminated soil pursuant to remediation activities in the Aberjona River wetlands triggers Section 404 jurisdiction. The governing regulations favor practicable alternatives that have less impact on wetlands. If no mitigated practicable alternative exists, impacts must be mitigated.	o Under this alternative no excavation will occur in Section 404 wetlands. Soil contamination in such areas will be remediated using in-situ volatilization which does not require excavation and subsequent filling.
o Massachusetts Wetlands Protection Requirements (310 CMR 10.00)[1]	o These requirements control regulated activities in freshwater wetlands, 100-year floodplains, and 100-foot buffer zones beyond these areas. Regulated activities include virtually any construction or excavation activity. Performance standards are provided for evaluation of the acceptability of various activities.	o Under this alternative, no excavation will occur in the regulated wetlands. Excavation of contaminated soil may occur in the wetlands buffer zone. In this case, the alternative will meet performance standards for activities in the buffer zone.

TABLE 10 (Cont'd)

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR ALTERNATIVE SC-10: IN-SITU VOLATILIZATION/EXCAVATION/ON-SITE INCINERATION/BACKFILL ON-SITE WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o Wetlands Executive Order (EO 11990)[1]	o Under this Executive Order, federal agencies are required to select alternatives that minimize the destruction, loss or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	o No excavation will occur in Section 404 wetlands. This is the best practicable alternative for treating contaminated wetlands.
o Floodplains Executive Order (EO 11888)[1]	o Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial value of floodplains. In addition, practicable alternatives must be selected that have less impact on wetlands.	o Excavation and filling are temporary disruptions, and filling will match preconstruction topography. Thus, there is no permanent disruption of floodplain values and the ARAR will be met.
o Protection of Archaeological Resources (32 CFR 229)	o These regulations develop procedures for the protection of archaeological resources.	o If archaeological resources are encountered during excavation, work will stop until the area has been reviewed by federal and state archaeologists.

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[1] Applicable

[2] Relevant and Appropriate

TABLE 11

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR MOM ALTERNATIVES:

MOM-2 Pump and Treat Source Areas
- 2B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 2B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-3 Pump and Treat Central Area
- 3B Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-4 Pump and Treat Source Areas and Central Area
- 4B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 4B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
1) Action-Specific ARARs		
o RCRA - General Facility Requirements (40 CFR 264.10-264.18)^2	o General facility requirements outline general waste security measures, inspections, and training requirements.	o Facilities will be constructed, fenced, posted, and operated in accordance with this requirement. All workers will be properly trained. .
o RCRA - Generator and Transporter Responsibilities (40 CFR 262 and 263)^2	o Provides standards for packing and accumulating hazardous waste prior to off-site disposal.	o Pretreatment, sludge management and off-site disposal will proceed in accordance with RCRA requirements.
o RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.31)^2	o This regulation outlines requirements for safety equipment and spill control.	o On-site facilities and activities will be designed and operated in accordance with RCRA requirements.
o RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56)^2	o This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	o Emergency procedures will be developed and implemented in accordance with RCRA requirements.
o RCRA - Manifesting, Recordkeeping, and Reporting (40 CFR 264.70 - 264.77)^2	o This regulation specifies the recordkeeping and reporting requirements for RCRA facilities.	o Records will be maintained during site remediation in compliance with this requirement.
o RCRA - Container Requirements (40 CFR 264 Subpart I)^2	o This regulation sets forth RCRA requirements for use and management of containers at RCRA facilities.	o Packing and accumulation of treatment sludges and other materials will adhere to these standards.
o RCRA - Land Disposal Restrictions (40 CFR 268)^2	o Provide treatment standards and schedules governing land disposal of RCRA wastes and of materials contaminated with or derived from RCRA wastes.	o On-site treatment will be conducted in accordance with standards to allow site-specific RCRA delisting of material.

TABLE 11 (Cont'd)
ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR MOM ALTERNATIVES:

MOM-2 Pump and Treat Source Areas
- 2B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 2B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-3 Pump and Treat Central Area
- 3B Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-4 Pump and Treat Source Areas and Central Area
- 4B(i) Pretretment and UV/Chemical Oxidation at Separate Treatment Plants
- 4B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
		bottom contours. These actions meet the terms of the U.S. Army Corps of Engineers Nationwide Permit No. 12 (33 CFR 330.5(a)(12)). This permit provides authorization under Section 404 for discharge of material for backfill or bedding for "utility lines", provided there is no change in preconstruction bottom contours. A "utility line" is defined as a pipe for the transportation of any liquid for any purpose.
o Massachusetts Wetlands Protection Requirements (310 CMR 10.00)[1]	o These requirements control regulated activities in freshwater wetlands, 100-year floodplains, and 100-foot buffer zones beyond these areas. Regulated activities include virtually any construction or excavation activity. Performance standards are provided for evaluation of the acceptability of various activities.	o Eextraction pipes will be laid underground through regulated wetlands, floodplains, and buffer zones. This will not cause loss of flood storage capacity, and will only temporarily disturb wetlands. The performance standards of the regulations will therefore be achieved. All treatment facilities will be constructed above the 100-year floodplain elevation (e.g., 48 feet above sea level.
o Massachusetts Waterways Licenses (310 CMR 9.00)[1]	o Controls dredging, filling, and other work in water of the Commonwealth.	o Alternatives involving source area pumping and central area treatment require placement of pipes under and across the Aberjona River. Pertinent requirements will be followed regarding dredging methods and management of dredged spoil.
o Massachusetts Certification for Dredging and Filling (314 CMR 9.00)[1]	o Establishes water quality-based standards for filling activities (CWA Section 401).	o Alternatives involving source area pumping and central area treatment require placement of pipes under and across the Aberjona River. Proper measures will be taken to avoid contravention of water quality standards (i.e., turbidity) during installation of pipes.

TABLE 11 (Cont'd)

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR MOM ALTERNATIVES:

MOM-2 Pump and Treat Source Areas
- 2B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 2B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-3 Pump and Treat Central Area
- 3B Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-4 Pump and Treat Source Areas and Central Area
- 4B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 4B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o DOT - Transportation of Hazardous Waste Requirements (49 CFR 171-179)^{2}	o Those regulations set forth DOT requirements for transportation of hazardous waste. These are generally identical to RCRA requirements at 40 CFR 263.	o All on- and off-site transport of treatment sludges and other materials will adhere to these standards.
o CAA - National Air Quality Standards for Total Suspended Particulates (40 CFR 129.105, 750)^{1}	o This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter.	o Fugitive dust emissions from site activities will be maintained below 150 ug/m^{3} (secondary standard) by water sprays and other dust suppressants.
o DEQE - Ambient Air Quality Standards for the Commonwealth of Massachusetts (310 CMR 6.00)^{1}	o This regulation specifies dust, odor, and noise emissions from construction activities.	o Fugitive dust will be controlled by water sprays or suppressants. All equipment will be maintained so as not to produce excessive noise.
o DEQE - Air Pollution Controls (310 CMR 7.00)^{1}	o Regulates new sources of air pollution to prevent air quality degradation. Requires the use of "Best Available Control Technology" (BACT) on all new sources.	o BACT will be used on all new sources.
o OSHA - General Industry Standards (29 CFR 1910)^{1}	o This regulation specifies the 8-hour, time-weighted average concentration for various organic compounds and 2 PCB compounds; site control procedures; training; and protective clothing requirements for worker protection at site remediations.	o Proper respiratory equipment will be worn if it is not possible to maintain the work atmosphere below these concentrations.
o OSHA - Safety and Health Standards (29 CFR 1926)^{1}	o This regulation specifies the type of safety equipment and procedures to be followed during construction and excavation activities.	o All appropriate safety equipment will be on site and procedures will be followed during groundwater monitoring.
o OSHA - Recordkeeping, Reporting and Related Regulations (29 CFR 1904)^{1}	o The regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	o These regulations are applicable to the company contracted to execute site remediation.
o CWA - National Pollutant Discharge Elimination System (NPDES) (40 CFR 122-125)^{1}	o Provides permitting process for surface water body point source discharges.	o Water discharges to the Aberjona River will be treated to ensure that violations of the Clean Water Act do not occur.

TABLE 11 (Con't'd)
ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR MOM ALTERNATIVES:

MOM-2 Pump and Treat Source Areas
- 2B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 2B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-3 Pump and Treat Central Area
- 3B Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-4 Pump and Treat Source Areas and Central Area
- 4B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 4B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o DEQE - Surface Water Discharge Permit Program Requirements (314 CMR 3.00)[1]	o Provides permitting process for surface water body point discharges. This requirement is generally identical to CWA NPDES.	o Water discharges to the Aberjona River will be treated to ensure that violations of the DEQE water discharge permit program do not occur.
o DEQE - Surface Water Quality Standards (314 CMR 4.00)[1]	o This regulation consists of surface water classifications which designate and assign uses, and water quality criteria necessary to sustain the designated uses.	o Water discharges to the Aberjona River will be treated to ensure that violations of the DEQE water quality standards for that water body do not occur.
o DEQE - Groundwater Quality Standards (314 CMR 6.00)[1] and Groundwater Discharge Permit Program (314 CMR 5.00)[1]	o This regulation consists of groundwater classifications which designate and assign uses, and water quality criteria necessary to sustain the designated uses.	o Class I groundwater quality criteria will be achieved at end of the remediation process.
o DEQE - Air Emission Limitations for Unspecified Sources of Volatile Organic Compounds (310 CMR 7.18(17))[2]	o Unspecified source with the potential to emit 100 tons/year of VOCs must install "Reasonably Available Control Technology" (RACT).	o Treatment of VOC air emissions from pretreatment units to 99.99 percent combustion efficiency in vapor phase carbon adsorption.
o DEQE - Hazardous Waste Management Requirements (310 CMR 30.00)[2]	o These regulations provide comprehensive monitoring, storing, recordkeeping, etc. programs at hazardous waste sites.	o During remedial design, these regulations will be compared to the corresponding federal RCRA regulations, and the more stringent requirements will be utilized. Note that Massachusetts considers liquids contaminated with PCBs greater than 50 ppm to be hazardous wastes (M002).
o DEQE - Air Pollution Control New Source Approvals (310 CMR 7.00)[1]	o Regulates new sources of air pollution to prevent air quality degradation. Requires the use of "Best Available Control Technology" (BACT) on all new sources.	o BACT will be used on all new sources.
o Employee and Community Right-to-Know Requirements (310 CMR 33)[1]	o Establishes rules for the dissemination of information related to toxic and hazardous substances to the public.	o Information dissemination procedures in these regulations will be used.

TABLE 11 (Cont'd)

ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR MOM ALTERNATIVES:

MOM-2 Pump and Treat Source Areas
  - 2B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
  - 2B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-3 Pump and Treat Central Area
  - 3B Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-4 Pump and Treat Source Areas and Central Area
  - 4B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
  - 4B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

WELLS G&H SITE, WOBURN, MASSACHUSETTS

REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
2) Action-Specific TBCs		
o RCRA - Proposed Air Emission Standards for Treatment Facilities (52 FR 3748, February 5, 1987)	o The proposal would set performance standards for RCRA treatment facility air emissions.	o Vapor phase carbon adsorption facilities and other non-incinerators that have air emissions will be designed to meet the proposed federal regulations.
o USEPA Office of Solid Waste and Emergency Response, Directive 9355.0-28; Air Stripper Control Guidance	o Establishes guidance on the control of air emissions from air strippers used at Superfund sites for groundwater treatment.	
3) Location-Specific ARARs		
o RCRA - Location Standards (40 CFR 264.18)[2]	o This regulation outlines the requirements for constructing a RCRA facility on a 100-year floodplain. 'A facility located on a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless waste may be removed safely before floodwater can reach the facility, or no adverse effects on human health and the environment would result if washout occurred.	o There is adequate space to site treatment plants outside a floodplain. Pipes extending from pumping areas and treatment plants through floodplains do not present any risk of washout due to flooding and will not displace floodplains.
o CWA - Section 404 Dredge and Fill Requirements (Guidelines at 40 CFR 230)[1]	o The placement for fill pursuant to remediation activities in Aberjona River wetlands triggers Section 404 jurisdiction. The governing regulations favor practicable alternatives that have less impact on wetlands. If no practicable alternative exists, impacts must be mitigated.	o There is adequate space to site treatment plants outside Section 404 wetlands. Excavation and subsurface placement of extraction wells and piping to and from source areas and treatment plants will be designed to match preconstruct

TABLE 11 (Cont'd)
ACTION-SPECIFIC AND LOCATION-SPECIFIC ARARS AND TBCS FOR MOM ALTERNATIVES:

MOM-2 Pump and Treat Source Areas
- 2B(i) Pretreatment and UV/Chemical Oxidation at Separate Treatment Plants
- 2B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-3 Pump and Treat Central Area
- 3B Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

MOM-4 Pump and Treat Source Areas and Central Area
- 4B(i) Pretretment and UV/Chemical Oxidation at Separate Treatment Plants
- 4B(ii) Pretreatment and UV/Chemical Oxidation at a Central Treatment Plant

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REQUIREMENT	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
o Inland Wetland Orders (302 CMR 6.00)[2]	o Defines wetland areas, establishes encroachment lines along waterways or floodplain areas, and regulates activities in these areas.	o Some pipes connecting central treatment plants will be laid across the river. In these cases, consultation with DEQE regarding proper construction will occur.
o Operation and Maintenance and Pretreatment Standards for Waste Water Treatment Works and Indirect Discharges (314 CMR 12.0)[2]	o Insures the proper operation and maintenance of waste water treatment facilities including operation and maintenance, sampling, and discharges.	o Guidelines appropriate for a wastewater treatment facility will be followed.
o Wetlands Executive Order (EO 11990)[1]	o Under this Executive Order, federal agencies are required to minimize the destruction, loss or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If no practicable alternative exists impacts must be mititated	o The placement of pipes in wetlands, is necessary to connect the central treatment plants. Therefore, it is consistent with the requirements of the Executive Order.
o Floodplains Executive Order (EO 11988)[1]	o Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial value of floodplains.	o The placement of pipes in wetlands, below grade, poses no additional flood hazard and meets the requirements of the Executive Order.
4) Location-Specific TBCs		
o EPA Groundwater Protection Strategy	o EPA classifies groundwater into three categories depending on current, past or potential use. This serves as a guide for protection of the resource.	o Wells G&H aquifer is a Class II B aquifer-potentially usable aquifer. At the end of remediation, all MOM alternatives will attain standards for Class IIB aquifers.

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[1] Applicable

[2] Relevant and Appropriate

9428b

TABLE 12

SUMMARY OF PRESENT WORTH COSTS FOR SOURCE CONTROL ALTERNATIVES

	Alternative	Total Present Worth (1988) Dollars		
		10^{-4} Target Level	10^{-5} Target Level	10^{-6} Target** Level
SC-1:	No Action*	799,500	799,500	799,500
SC-3:	Excavation On-Site Incineration/Backfill On-Site	7,301,800	7,465,900	7,468,600
SC-4:	Excavation/Off-Site Incineration/Backfill With Clean Off-Site Soil	21,597,100	22,138,600	22,149,700
SC-5:	Excavation/On-Site High Temperature Enhanced Volatilization/Backfill On-Site	6,424,800	6,567,600	6,570,300
SC-7:	Excavation/On-Site Supercritical Fluids Extraction/Backfill On-site	7,372,700	7,536,800	7,540,100
SC-8:	Excavation/On-Site Enhanced Volatilization/On-Site Incineration/Backfill On-Site	5,733,100	6,136,000	6,181,400
SC-9:	Excavation/On-Site Enhanced Volatilization/Off-Site Incineration/Backfill with Treated and Clean Off-Site Soil	6,386,800	8,610,300	9,020,900
SC-10:	In Situ Volatilization/Excavation/On-Site Incineration/Backfill On-Site	2,285,800	3,014,800	3,155,300
SC-11	In Situ Volatilization/Excavation/Off-Site Incineration/Backfill with Clean Off-Site Soil	3,111,000	5,734,400	6,239,700

* Present worth analysis based on 30 year period and 5% discount rate for No Action alternative only. No O&M required for all other alternatives. Therefore, present worth equals capital cost.

** Cleanup levels for the Wells G & H Site are based on a 10^{-6} target level.

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APPENDIX A
RESPONSIVENESS SUMMARY